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MADRAS EXHIBITION

OF

1859

OF THE

Raw Products of Southern India.

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ac

ON THE COTTON

OF

THE GIGANTIC SWALLOW WORT,

(*CALOTROPIS GIGANTEA*;)

AS, ALSO,

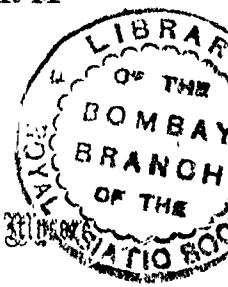
ON THE SILK WORM

AND

SILK MANUFACTURE

IN

Bengal, Bombay, China, Madras, and Mysore.



MADRAS:

PRINTED AT THE SCOTTISH PRESS, BY L. C. GRAVES.

1858.

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ON

THE COTTON

OF THE

Calotropis Gigantea or Gigantic Nettle-Wort,

AND ON THE

MANUFACTURES FROM THE SAME.

LONDON, 14, HIGHBURY PARK, *3rd June* 1857.

From Assistant Surgeon J. A. Ratton, Madras Medical Service, to Edward Balfour, Esq., Secretary to the Madras Exhibition for 1857.

SIR,—I have the honor to forward to you, for the information of the Right Honorable the President and Members of the Committee of the Madras Exhibition for 1857, the enclosed two letters from Messrs. Thresher and Glenny* and that from Messrs. Desgrands et fils, Brokers, Lyons† which, I believe, will prove highly interesting, connected with the subject to which they refer. I cannot but regret that my absence from India should have unavoidably led to the delay in laying them before the Right Honorable the President and Committee—as these letters only came to hand in time to forward them by the present Mail—which I do with the concurrence of Messrs. Thresher and Glenny, as they are explanatory of, and pertain to, the specimens forwarded to the Exhibition.

* December 22d, 1856. January 10th, 1857.
† Lyons. 26th January 1857.

I believe that the results arrived at by Messrs. Thresher and Glenny will prove gratifying to the Committee; and that the great exertions made by this eminent Firm, and the experiments instituted, regardless of all expense, will meet with every consideration, and support from the Committee—and that, under the peculiar circumstances, all the specimens sent will be permitted to compete at the Exhibition.

In furtherance of a subject which promises, if duly encouraged at home, and supported by the local means at the disposal of the Right Honorable

the President and Committee, to become one of future importance in a commercial point of view, I have the honor to draw attention in an especial manner to the following quotations, and some points in these letters, which seem to me to deserve special attention.

In the first place, it is extremely gratifying to observe* the samples of Mudar Cotton manufactured by itself from the raw state to the stocking and waistcoat, justly considered a triumph, the result of Model machinery constructed for the purpose. "I can assure you that the manufacturing the Mudar Cotton by itself is considered a triumph here, and I am only sorry the time was so limited, otherwise I think I could have got it mixed with silk."

* Letter, 10th Jan. 1857.

† "The real difficulty I have had to encounter has been the shortness of time, and limited quantity of material."

† Letter, 22d Dec. 1856.

"Had I more time and material, I could probably get other samples."

To be ascertained—"At what price and in what quantity it can be obtained; that is to say, at what price per ton it can be put on board at Madras, and the cost of freight per ton."

The opinion of the manufacturer expressed in the letter from Messrs. Desgrands et fils, speaking of it in reference to embroidery, confirms in a great measure the views entertained by Messrs. Thresher and Glenny upon the usefulness of this material. Speaking of it, he says, "Le luisant de ces filaments aurait un grand merite, si on pourait arriver a fabriquer convenablement des filés avec cette matière." This, and more than this, Messrs. Thresher and Glenny have, by their untiring perseverance already arrived at, and I cannot doubt the correctness of the opinion expressed by Mr. Glenny, when he mentions that he believes, had he had more time, he could have got it mixed with silk, though the want of machinery adapted to the purpose had for the time prevented this.

"I have not been able to get any of the silk-spinners to mix it with silk: they have tried, but have no machinery suited to it."

I had a conversation a few days ago of an hour and more with Mr. Glenny, the present head of the Firm. He purposes to write to me further upon the subject. He believes that he will be able to improve greatly upon the specimens already forwarded to the Committee, by improved machinery. But for this, he requires to institute experiments upon a

larger scale, and requires a greater supply of the cotton. He is however of opinion that it will be found to work up best with wool, and to produce a material in imitation of Cashmere—points that have yet to be determined. I now beg to request the earnest attention of the Right Honorable the President and Members of the Committee to the request of Messrs. Thresher and Glenny which they desire me to express, that they may be favored as speedily as convenient with as large a supply of the Mudar Cotton as can be collected, to submit it to the test of further experiment upon a larger scale, and from which they contemplate the most gratifying results.

With a view, however, to bring it to the ultimate test of the commercial value which it will bear, and with which it must compete in the market. I believe that no single handed Firm, however well disposed to experiment, and to expend their capital, can, in a case like that under present consideration, arrive at a just conclusion either as to the article itself, or to themselves. I believe that the Right Honorable the President and Committee only have the power necessary to ensure the ascertaining of this point—by bringing to bear upon the subject the weight which their authority can command, and their experience direct.

In connexion with this, I beg earnestly to recommend that, besides forwarding to Messrs. Thresher and Glenny as large a quantity of the Mudar Cotton as can be procured within the period of a month, (and which, should the Government direct the Collectors of Districts throughout the Madras Presidency to lend their assistance, would be very great,) that the Government would bring the subject to the test of practical experiment—by planting out land (from shoots, not cuttings) with the "Calotropis gigantea," as an experimental Farm, and for which the extensive waste land between Madras and Chingleput, and around that Station, offers every facility. While with a view to see if *cultivation* improved the staple of its cotton as to length and strength, as well also to ascertain its relative produce, and the lowest rate at which it could be produced and sent into the Home market—that upon a second portion of the land the Plant should be *cultivated*—and a third experiment be made with the Plant upon *good land* and *under cultivation*.

But the concurrence and assistance of the Collectors of those Districts wherein it is known to flourish more luxuriantly would be very desirable. I may likewise name Mysore, where an experimental cultivation

might lead to very interesting results. For, by a reference to my Report upon this Plant, which I had the honor to forward to Government last year—it will be perceived that I there allude to its luxuriant growth throughout the Mysore country. On this part of the subject I beg further to remark—that on my late visit to "Demerara" in April last, I there observed the Plant growing most luxuriantly, attaining a height and size, which I had never before seen—certainly not less than from 12 to 18 feet in height, with a corresponding general growth, and circumference of ground covered by it. What I have thus witnessed both in Mysore and Demerara—shows at least that an improved soil, even without cultivation, enables the Plant to attain to a far greater size, than is met with around Chingleput, yet from the cotton from which station, have been furnished the beautiful and gratifying samples already manufactured by Messrs. Thresher and Glenny, now before the Committee.

I feel the less diffidence in making the proposal of such an experimental Farm, entailing but a small expenditure, both from a knowledge of the earnest endeavours which the Right Honorable the President has shown personally, as well as in connexion with the Committee, to develop to the utmost the latent resources of the country and the well-known, earnest and repeated experiments instituted by the Honorable the Court of Directors at a great expense, to improve the culture, produce, and quality of the cotton plant, and which by analogy would, I believe, be equally directed to the development and improvement of any other source of native produce holding out a reasonable prospect of eventually becoming of commercial importance.

I will venture further to suggest for consideration, that viewing the difference of the price of labour in England and in India, the manufacture in India of the yarn finely spun by the aid of improved and suitable Machinery (such as used by Messrs. Thresher and Glenny) would materially lessen the price to the Home manufacturer.

A further fact of interest has been also ascertained. Silk cotton (Bombax pentandrum) is capable of being usefully manufactured, mixed in equal parts with country cotton, and in the same proportion with Mudar Cotton. This we perceive in the interesting samples of web forwarded by Messrs. Thresher and Glenny. Yet these samples are inferior to what the Firm could produce, had time been allowed, as these webs are manu-

factured from the uneven yarn spun in India from Silk and Mudar Cottons.

I have purposely omitted to allude to the Ootahmenay cotton (however curious) not to divert the attention of the Committee from the subject of the Mudar cotton, one of practical importance. I now only allude to it, to say, that, though in the letter from Lyons the manufacturer speaks relative to the Ootahmenay, the same must apply with equal and greater force to the Mudar; and I therefore look upon it in the light rather of a mistake he makes between the two names. In conclusion, it will be observed that Messrs. Thresher and Glenny request that the samples sent should appear in the Exhibition Catalogue, with a copy of which on its publication, they desire to be furnished. And that they likewise desire, that a suitable Glass Case should, at their expense, be provided for the due exhibition of these truly interesting samples.

The cordial and earnest manner in which these Gentlemen have, without reference to expense, embarked in the subject, will, I believe, meet with every consideration and assistance from the Right Honorable the President and Committee. I request you will have the goodness to forward me on publication a copy of the Catalogue of the Exhibition, and also of the awards of the Committees, and to favor me with a communication in acknowledgment of the present, informing me of the position taken by this product in the Exhibition, and such other points relating to it as may be considered to prove interesting either to Messrs. Thresher and Glenny or to myself.

J. A. RATTON, *Assistant Surgeon.*

I also beg to recommend that a quantity of the Mudar cotton corresponding to that requested in their letter, be also sent to Messrs. Desgrands et fils, Commissionaries, a Lyon, for further experiment, as requested by their correspondent.

LONDON, 152 STRAND, *Jan. 10th,* 1857.

SIR,—After many fruitless attempts, I have at last succeeded in manufacturing the Mudar cotton by itself and by the last Mail I dispatched a small case containing Samples of the Mudar cotton in all stages of manufacture, from the raw state to the manufactured stocking and waistcoat. I do hope, therefore, that under the very particular circum-

stances, the Committee will allow it to compete at the Exhibition, although it may arrive later than the time named. I also sent a sample of Ootahmenay cotton and American cotton equal parts, manufactured in the web. I sent a sample of the yarn in the former packet. I was obliged to have model Machinery to work the Mudar cotton, and I think you will see that we have succeeded very well.

As I before named, I have not received any particulars of the Regulations of the Exhibition, and therefore I must trust to you to do all that is necessary, and I hope the Committee or counsel will make due allowance for the difficulties we have had to contend with. I shall be glad to have a Catalogue of the Exhibition when it is published.

I have enclosed a Memo. of the last articles sent, and hope they will prove successful. I can assure you that the manufacturing the Mudar cotton by itself is considered a triumph here. And I am only sorry the time was so limited, otherwise I think I could have got it mixed with silk.

JOHN GLENNY, *for Thresher and Glenny.*

Web from Ootahmenay cotton and American cotton equal parts.
Mudar cotton in the several stages of manufacture.
Waistcoat and half hose manufactured from Mudar cotton.

LONDON, 152 STRAND, *December 22nd,* 1856.

SIR,—By the Mail of the 20th I forwarded the Samples as per list enclosed. And I can scarcely tell you the difficulty I have had in getting only these few small samples—as almost every manufacturer and spinner that I have sent it to, has declined to even try it in so small a quantity. And more particularly as it is a very difficult material to work up, I have not been able to get any of the silk-spinners to mix it with silk—they have tried but have no machinery suited to it—and the present machinery literally blows it away, the material is so very light; indeed it is more of a down than cotton—you will see by the samples, that mixed with cotton it makes a very good thread or yarn—but whether the cotton is improved or worsted by the mixture we have yet to learn. It

certainly makes it softer, but I think it will be less strong. It would make into paper—but except very cheap there are other things that answer as well. The real difficulty I have had to encounter has been the shortness of the time and limited quantity of material. Had these been sufficient, I would have sent a sample of paper from it, but the paper-makers cannot or *will not* try an experiment with less than 5 or 6 cwt. of the material. That you may see that I have left nothing untried, I just name that I have tried the principal spinners of Ireland, Bamsley, Leeds, Manchester, Nottingham, Derbyshire, &c. which represent Linens, Sheetings, Flannels, Cloths, Calicoes, Stocking webs and Lace making —and it is only by personal attention that I have got the samples sent, had I more time and material I could probably get other samples, but, in three cases out of every four that have really tried, I have had it returned as useless. I have hitherto been speaking only of the Mudar cotton. The finer kind, Ootahmenay cotton, was so very small in quantity that I could scarcely get any thing done with it. You will see however that I have sent a sampler of it in yarn, and by the next mail, I will send a small sample of stocking web, made from the yarn. And I hope to have one or two other samples. You will observe that I have only been enabled to send samples to show what can be done with the material. As I have not had enough to make any one article from it, I hope these specimens will be admitted into the Exhibition, and that any informality as regards the Rules &c. will be excused, as I have received *no copy* of Rules or Regulations of the Exhibition, and that in passing judgment upon them some allowance will be made for the difficulties I have had to contend with. The most valuable material you have sent me is the Fibre of the "Calotropis Gigantea;" but the quantity was so small that I could only make a Twine from it: but there are many purposes to which it can be applied.

Before any opinion can be given as to use of either of the materials as an article of manufacture, it must be ascertained at what price and in what quantity it can be obtained, that is to say at what price per ton they can be put on board at Madras and the cost of Freight per ton.

You will observe that the yarns spun in India work up very uneven. I shall feel much obliged if you will do all that is necessary to put the samples in the Exhibition Catalogue, &c. and any expense that you incur

if you will let me know I will remit you the amount. I presume you will have to get a case made for them, and there will probably be other expenses; but whatever they are, I will remit as soon as I know the amount. The last parcel I sent, viz. that by mail of 20th, is addressed to you to the care of Mr. Watkins, No. 2, Armenian Street, Madras, and contains a small instrument from Miss Supple, and the former one to the care of Messrs. Binny and Co. and you may probably have to apply for it.

JOHN GLENNY, *for Thresher and Glenny.*

No. 1. Twine from Fibre of the inner part of "Calotropis Gigantea."
„ 2. Twine from the rougher parts or waste of the same.
„ 3. Yarn of Mudar Cotton—*alone.*
„ 4. Yarn of Mudar Cotton one part, and wool two parts.
„ 5. Yarn of the same—dyed.
„ 6. Yarn of Mudar and American Cotton, equal parts.
„ 7. Yarn of Ootamenay Cotton and American Cotton, equal parts.
„ 8. Web from Mudar Cotton and American Cotton, equal parts.
„ 9. Web from Mudar Cotton and Country Cotton, equal parts spun in India.
„ 10. Web from silk Cotton and Country Cotton, equal parts spun in India.

Flannel from Mudar Cotton one part, and Wool two parts.
Flannel from same, but dyed Wool.
Flannel from same, but dyed after being manufactured.

DUBLIN, 4 SYNND PLACE, 8*th July* 1857.

From Assistant Surgeon J. A. Ratton, to Edward Balfour, Esquire, Secretary to the Madras Exhibition for 1857.

SIR,—In continuance of the subject of my letter of the 3rd ult., I have now the honor to forward you for the information of the Right Honorable the President and members of the General Committee of the Madras Exhibition for 1857, the enclosed letter from Messrs. Thresher and Glenny, requesting to be favored with a copy of my Report to the

Committee upon the Mudar or Calotropis Gigantea, and likewise with a few Cwt. of the Cotton.

It is not, I believe, possible at present to state either at what price the article can be shipped from Madras, or the supply that can be depended upon, as both will depend upon the uses to which this material shall eventually be found adapted. The consequent demand for it, the corresponding planting of, or cultivation which this may induce, and its improvement either as to quality, or the quantity produced by simple cultivation, and in an improved soil are points necessary to be ascertained in the manner I had the honor to recommend to the Committee in my last letter, before any correct opinion can be formed in reply to the queries relating to this part of the subject.

I have written to Messrs. Desgrand et fils, Lyons, mentioning that I have on their behalf requested of the Committee the favor of forwarding them a supply of the Mudar Cotton corresponding to the demand made by their Correspondent, to enable him to prosecute further experiments with the material.

The notice of the Committee may perhaps not have been attracted to the paragraph in the "Times" of the 4th ult., directing attention to the high price of silk crop in France. This will have made itself felt at Lyons, and, accidental though it may be, shews the possibility of a recurrence and how acceptable to the manufacturers a material of this character would be, if found capable of being advantageously mixed up with silk. The occasion therefore coincides favorably to second the demand made by Messrs. Desgrand et fils, and by which will be secured the further co-operation of his correspondent in the ascertaining of this most interesting point, upon which undoubtedly much of the value of this material will depend.

J. A. Ratton.

London, 152 Strand, *July 4th*, 1857.

Dear Sir,—As we are very anxious to avail ourselves of every source of information respecting the Mudar Cotton, we shall feel very much obliged if you will procure for us a Copy of your own report to the Committee upon that subject.

We shall feel further obliged if you can obtain for us a few Cwt. of the Mudar Cotton, as with a larger quantity we shall very soon be able to ascertain whether or not it will be worth importing into this country for one class of manufacturers. In the meantime it will be very desirable to learn at what price the article can be shipped, and the probable supply that can be depended upon.

THRESHER AND GLENNY.

To J. A. RATTON, ESQ.,

LYONS, *26th January*, 1857.

To DR. J. A. RATTON, *Chingleput near Madras.*

We have the honor to refer you to our letter of the 10th November last, and to confirm its contents.

Since then, the friend to whom we had handed your several samples of cotton, has acquainted us with the results of his examination of them, and the following is what he writes us on the subject :

" The kind of cotton which you call *Ootahmenay*, might perhaps be used to a certain extent in our Establishment, which makes up large quantities of thread for Embroidery work. The Gloss of this filament would be of great value, if we could but manage to make it suitable for being spun into yarn : but it does not appear to have sufficient *strength*, or *body*, for that purpose : and it neither *felts*, nor *winds*, so well as the cottons generally in use : while in the process of cording, it is apt to crumble into dust."

" It would be necessary therefore to try further experiments on it, in many different ways, and endeavour to find some new method of obtaining a more satisfactory result : and for this purpose one ought to have at one's disposal some hundreds of kilogrammes of this substance."

" If you think fit to send for this quantity, I shall willingly afford every possible assistance in making the experiments : but it will be necessary, in the first place, to let me know what will probably be the cost. In case of need, something might be done even with 50 kilogrammes."

"Consider then, Doctor, whether it will suit you to make a fresh consignment of the cotton in question, to the extent desired by our friend: informing us, at the same time, of the cost of the article; in which case we are entirely at your disposal for the purpose of following the matter up."

Awaiting the pleasure of hearing from you, we present our sincere respects.

DESGRANDS ET FILS.

ON

The Silk Worm and Silk of India.

TO RICHARD MOLESWORTH, Esq.

Dear Sir,

I wrote you on the 19th Instant enclosing the copy of a letter to Government and have now the pleasure to transmit their answer with my further correspondence for the establishment of the cultivation of mulberry trees.

You will see by plate first and second on the articles silk in the Encyclopedia that the hooks for the passage of the silk to the reel, are placed above the goer and comer, and the second axle stands diagonally to the frame, which has the effect of exposing the threads to be broken in passing the hooks at nearly a right angle, as well as that in this way the coggs of the wheels do not play so smoothly on each other, and altogether the reel has a very awkward appearance.

To remedy this I have caused a moretice to be made in the middle of the comer and goer, through which an inverted T may be moved up or down, and fastened with a pin, with the hooks on the heads of the cross piece.

In this way the silk is brought over the hooks at as obtuse an angle as may be found necessary, and the motion of the wheels amended, by placing them at right angles to each other, with the axle parallel to the frame.

Perhaps the fear of disobeying His Sardinian Majesty's orders, has hindered the Italians from seeing these defects in their reel.

I am with much regard,

Dear Sir,

Your very obedient Servant,

(Signed) JAMES ANDERSON.

FORT ST. GEORGE,
April 26th 1791.

TO THE HONORABLE SIR CHARLES OAKELEY, BART.

Senior Member and Council.

HONORABLE SIR,

Since the favor of your letter of the 20th ultimo, I have supplied the Commandant of Poonoomallee with silk worms, and a quantity of new laid eggs, knowing there are several hundred mulberry trees that had been planted in the different gardens of the officers on that station.

Indeed I have been at the expence of watering the trees in this dry season; but as Poonoomallee will make a very eligible station for a new colony, it would be better that you write to Captain Lixfield and request of him to have the trees watered at the Company's expence.

There are likewise mulberry trees at the Cantonments of Sheverum, Cheveremurdoo, Arcot and Jemeconda, to which it would be well that some immediate attention was paid, as they may perhaps be deemed beyond the limits of the Revenue Board; and it would be difficult for me to visit such distant places at this time.

The quantity of mulberry trees in the fort of Chinglepat has induced Captain Campbell to take a supply of the silk worm eggs, and I have furnished Mr. Binny at Masulipatam as well with them, as a reel for winding off the silk, since he had been at the expence and trouble of importing the white mulberry from Hydrabad at my request, and has now an abundant stock of them for that district.

Conceiving the success of an undertaking of this nature to depend on the number and extent of the works, that in case one should fail, it may readily be supplied with a fresh breed of eggs or worms from another. I have the pleasure to say that there are several Gentlemen and Ladies besides those I have mentioned who are taking care of silk worms; but on this idea your countenance and assistance appear chiefly necessary, to render the pains I have been at effectual; for a great, valuable, and permanent establishment.

I shall therefore be happy to hear from your Revenue Board, having something to say as well on the culture of the plant, as the management of the insect, which may be useful in practice.

I have the honor to enclose the copy of a letter to Mr. Molesworth on an improved structure of the Piemosetess reel of which you may approve, and recommend that a sufficient number be immediately constructed, for supplying each of the Collectors with one, to serve as a Model.

I am with all due respect,

Honorable Sir,

Your most obedient and humble Servant,

FORT ST. GEORGE,
May 2nd, 1791.

(Signed) JAS. ANDERSON.

TO THE HONORABLE SIR CHARLES OAKELEY, BART.

Senior Member and Council.

HONORABLE SIR,

As the heat of the weather increases, the eggs of the silk worms hatch in six or seven days and the insect completes its evolutions within two months.

Although I have planted five thousand mulberry cuttings, this rapid increase renders it impossible for me to supply them with food, never did man undertake the care of a family so needy and numerous.

I have the pleasure to assure you however that the remedy is very easy, for the mulberry tree when watered grows more quickly and luxuriantly in the hottest season of the year than at any other time, and cuttings I put into the ground only a month ago are already bearing fruit as well as leaves.

As my observation comprises both extremes of the year, it is with pleasure I declare the practicability of cultivating silk in warm climates, to more advantage, than in those that are colder, and in this respect the cost surpasses Bengal in the rates of three to two, on account of the four months cold weather when the eggs cannot be hatched there.

Lest a communication with the Revenue Board should prove a distant object, they may direct two or three dozen mulberry cuttings to be planted immediately in the water courses of the present village gardens, which will be sufficient to afford plants next year for the grounds that are ordered to be laid out.

In the mean time Mr. Corbet—who has been in Italy, and taken a fancy to look after the silk worms may be of great assistance in the care of them, which you must be sensible I cannot always attend to,—may by granting him some slender appointment, be directed to see the mulberry trees watered and the leaves sent in, as this alone has hitherto cost me an infinite deal of trouble.

I hereby mean the garden at the public Rooms at the play House and His Highness the Nabob's commonly called old Mackay's garden as well as several smaller gardens at Vepery and St. Thome where there are altogether about five hundred mulberry trees.

I do not include Mr. Chase's garden on the plain, Mr. Hall Stewart's in the Black Town now Mr. Popham's at Vellore, as these Gentlemen are taking care of silk worms themselves.

I am with all due respect,

Honorable Sir,

Your most obedient and very humble Servant,

Fort St. George, (Signed) Jas. Anderson.

May 4th, 1791.

TO THE HONORABLE SIR CHARLES OAKELEY, BART.

Senior Member in Council.

HONORABLE SIR,

Not yet having heard from the Board of Revenue, permit me to acquaint you that since writing yesterday, I have been favoured with a letter from Captain Mackay, stating the existence of four hundred very thriving mulberry trees in his garden, at Arnee, and his readiness to plant cuttings of them in all the gardens of the neighbouring villages; as well as to take care of silk worms, as far as his other avocations will permit.

Considering how difficult and rare it is to find a person of that quick apprehension Captain Mackay possesses, I must here beg leave to deviate from my first intention for a moment, and recommend that Captain Mackay be supported by your influence and authority as soon as possible, for although Arnee stands in what is called the Nabob's country, yet in case it is restored, His Highness can never be displeased that the country has been improved by our possession.

Some months ago Mr. Dighton acquainted me, he was rearing mulberry trees at Nellore, in hopes I would supply him with the insects, on this account I forwarded eggs by his brother Lieut. Dighton a few days ago; a similar requisition comes from Mr. Chamier, being possessed of abundance of mulberry trees at Madepolum, wherefore I must beg leave to recommend all these gentlemen to your particular favor.

In the gardens of Mr. Wynch and Mr. Richardson, there are mulberry trees, enough to cover the whole Province of Ganjam; and I sometimes ago sent the eggs of the worm to the latter: the Chief's garden at Vizagapatam, and Paymaster's garden at Ongole contain a great many, as well His Highness the Nabob's garden at Sautgurry.

The beauty of the foliage and flower of the fruit seem every where to have recommended this celebrated tree to some notice, and attention; and there can be no doubt the country possesses many, of which I have yet had no information.

Those I have mentioned, however, will be sufficient to show you the ground on which I have overhopped my first boundary, and come to the resolution of introducing the culture of the mulberry, and the silk into the country at one and the same time, believing it will be difficult to fix the attention of the people to the proper care of a plant, without likewise shewing the use to which it was applied.

We shall save an expence incurred at Cossimbazar of raising the grounds, to prevent their being flooded; as here we have abundance of ground that is already sufficiently high, and yet low enough to be watered by wells, which must here be preferred to tanks that are dry in the hot months, it will therefore be apparent that rice grounds should not be laid out in mulberries.

The mulberry fields in Bengal, are first well worked with manure, and the cuttings planted as thickly as we plant cabbages, the tender tops of which are cut off to feed the worms, and prevent the tree ever rising above two or three feet above the surface of the ground, so that a mulberry field at a little distance appears like a field of green corn.

This method will answer perfectly here, as the leaves are larger, as well as more tender, and succulent than when the tree is suffered to grow up.

The houses are a square building, the same as the houses of the natives here, which we commonly call a Mallabar house, in the side of the entry the family inhabit, the other three sides, are appropriated to the worms; it is therefore superfluous to say more on this head excepting that I have thought my worms were more healthy in an upper room, than in a lower, in a dry situation than a damp, and that a southern aspect was better than any other.

The apparatus are only two instruments, the one a Bamboo basket six feet wide, in which the worms are reared, called a Dally; the other a square Bamboo mat of the same dimensions with a spiral fillagaree on one side, to support the worm in spinning; which is called by the Bengalese a Chunderkee.

The custom in Bengal of tearing the male from the female, after a union of five hours is erroneous, as I have found the eggs succeed better, when the males and females were suffered to separate of their own accord.

I have found the common coarse cloth called Dungaree unbleached, the best material for the females to lay their eggs on and the eggs should be preserved from the open air and from vermin in the common unvarnished earthen pot of the country, called a kedgeree pot; excepting, at daylight in the morning when they should be examined to see if any have hatched, and the young removed on a fresh mulberry leaf.

I have thus briefly stated all that appears to me of any importance, for the full establishment of a cultivation of silk in this country, the further execution of so laudable a work must for the present necessarily rest with you.

I have the honor to be, with all due respect,

Honorable Sir,

Your most obedient and very humble Servant,

FORT ST. GEORGE,
May 5th 1791.

(Signed) JAS. ANDERSON.

TO THE HON'BLE SIR CHARLES OAKELEY, BART.,

Senior Member in Council.

HONORABLE SIR,

I am favored with your letter of 7th instant and sensible you will have patience with any thing material I can communicate on so important a subject when it appears that by this examination of a gentleman at the silk works in Bengal 12 cocoons reared here from Bengal eggs produced 10½ grains of silk, whereas that reared on the spot yields only six grains of silk from the same number of cocoons.

This communication I am favored with by Mr. Chafe who sent some of the cocoons thither at an early period and has otherwise

contributed greatly to the advancement of this work by his personal care and attention.

I am likewise sensible that the communication of my letters to the Board of Revenue must be attended with trouble, but cannot admit any loss of time in support of your wishes while every mulberry cutting may be valued at so many bales of silk.

The mulberry tree is so sweet a plant, it is greedily devoured by cattle and every mulberry plantation must be securely fenced.

I therefore recommend that the different Collectors or most adjacent Paymasters be immediately ordered to employ proper persons for fencing as well as watering the trees I have mentioned excepting those at Inneconda which are in the Commandant's garden and may be fully attended to by a letter to Captain Mackinnon.

The dryness of the climate is the only difficulty to be guarded against here in the culture of silk. I will therefore recommend that the Revenue Board lose not a moment in obtaining an account of the number, size, and state, of the wells of water on the Coast and the Collectors instructed to communicate the wishes of Government to the Natives by every means in their power, that those which require it be repaired at the only season when the work is practicable.

The Natives are reasonable and attentive, sensible too that wells of water independent of any other quality are public blessings, and will readily use their utmost endeavours to satisfy Government in a point so essential to their own welfare.

But when it is pointed out to them that by this means they will likewise be enabled to cultivate waste spots, and enjoy the most perfect vegetation in the hottest and dryest season of the year, very little further assistance will be necessary to complete the work in which we are engaged.

The deepest well I have seen in India is in Wallajanagur near Arcot ; I had the curiosity to measure the rope with which the people were drawing water and found there was a distance of sixty feet from the surface of the ground to the surface of the water, and

may venture to say, that no part of Hindostan is inhabited where the water lies at a greater depth.

In the inland country the water stands in wells generally from 15 to 20 feet in the hottest season, and on the sea coast the depth seldom exceeds ten feet.

It is possible there may be water courses from the river on the island of Cossimbazar, as we have that advantage here in the neighbourhood of all the rivers, but if the water is raised to the summit of the bank it is evident that those of the Ganges are more lofty than the banks of smaller streams.

As the introduction of silk here must be attended with increase of all the present branches of Revenue by the consumption of necessaries depending on a richer population and nothing promises so fair to repair the waste of different Mysorean wars, I think it altogether worthy your attention to hold up an exemption from taxes on mulberry plantations or silk reared by the natives.

I have the honor to be, with due respect,

Honorable Sir,

Your most obedient and very humble Servant,

FORT ST. GEORGE, (Signed) JAS. ANDERSON.
May 9th, 1791.

TO THE HONORABLE SIR CHARLES OAKELEY, BART.

Senior Member in Council.

HONORABLE SIR,

Although I earnestly solicited an immediate intercourse with the Board of Revenue yet unprepared as they must have been, now that you have forwarded my letters, any direct communication betwixt them and myself appears now altogether useless.

The further correspondence that may be necessary, being supported in the manner it stands at present, is likewise most consistent with the order of the service, and comes with more weight and efficacy from your Board.

You will not be surprised therefore that I am satisfied every thing regarding the business is in the best possible train; and you may rely on the same zealous attention I have ever professed to ripen into full maturity a work of such magnitude as the culture of silk may become in the only country where it has been discovered, that the insect continues in full perfection throughout the year, as well as the tree on which it is fed.

It is only necessary for me to observe that the operative part divides itself in three great branches; these are gardeners or laborers to cultivate the plant, families of persons to feed and manage the worms, and persons trained up to wind off the silk from the cocoon.

Basket-makers and carpenters may be added as a fourth branch of the business, but as every part of the country already abounds with these trades, it is needless to attend otherwise to this head than merely to mention it.

The first branch, or cultivation of the plant, on which I have already been full and circumstantial, is all that merits your immediate attention, the introduction of the worms I shall manage at leisure being only solicitous to preserve the breed, as it is precarious getting them from Bengal.

The first branch of gardeners or laborers will only find employment during the hot months in the mulberry plantations, when they can be employed in no other way; on account of the dryness and hardness of the earth; but in the wet months they may work in the rice-ground.

The business considered strictly therefore reduces itself into two branches that must be constantly and fully occupied throughout the whole year, viz., those who take care of the worms and those who wind off the silk.

Permit me to acknowledge the distinguished notice you have been pleased to take of my feeble exertions in this business, which I shall be happy at all times to merit.

Being with due respect,

Honorable Sir,

Your most obedient and very humble Servant,

(Signed) JAS. ANDERSON.

FORT ST. GEORGE,
May 12th, 1791.

TO DOCTOR ANDERSON.

My Dear Sir,

I received your favour of the 19th Instant with the Courier, for which I am much obliged. You have taken a mode to excite emulation that will not fail to add to my desire of rendering myself worthy your too liberal commendations. I am now confirmed in my apprehensions that the ants have ruined the eggs, as not a worm has appeared these four mornings, I have saved a few from the wreck of my expectations; but hope you will be able to supply me with a few more as I have taken every precaution to prevent a similar accident.

I am my dear Sir,

Your truly obedient Servant,

(Signed) Robert Mackay.

Arnee, 21*st May* 1791.

TO JAMES ANDERSON, Esq.

My Dear Sir,

Having been honoured with your letter of the 17th instant, I yesterday visited the gardens at the Cavalry cantonments near Arcot. Though vast numbers of the mulberry trees there have been destroyed and more have perished for want of water; yet sufficient remains to afford some millions of cuttings.

In my garden on the north bank of the Palar there are about sixty trees, measuring at an average sixteen inches in circumference about the middle of the stem; and the branches (overgrown small wood) would supply a great number of cuttings; though not having been watered since the cantonments were broke up they are not so healthy as formerly. In the gardens of Messrs. Walker Geckie, and Watson, which are also situated in the low ground, there are about a hundred young trees twelve or sixteen feet high, and also a hedge of about three hundred paces in length, but stinted in their growth for want of watering and the same in Major Young's garden, where there is a mulberry hedge about 500 paces in extent and upwards of twenty feet high in some places, but the twigs are so weak and

feeble, that a great deal would be lost in taking cuttings from them now. In Mr. Fitzgerald's garden there are about 100 bushes well watered and taken care of full of leaves and fruit in the greatest luxuriance. Besides these there are several more gardens where there are a few mulberries. I believe most of them have been cuttings from the trees in my garden, which are now six or seven years old, and mostly of the large China mulberry. They might be cultivated at a very inconsiderable expence, as a stream of water runs through every one of the gardens except Major Young's, which is situated on the high ground about two miles from the river, but might also be watered from a tank about 200 yards from the hedge.

Dr. Berry distributed a quantity of eggs among us, and I hope notwithstanding the scarcity of food, to be able to carry a few of the worms through the different stages of existence, in order to shew my friends the mode of treatment. Of the few mulberries we have here, most have been cut down and replaced, the increase of the trees being the primary object.

Mr. Kindersly has as yet received no official instructions from Government on this subject, but Mrs. Kindersly with other ladies are very assiduous in attending to the worms.

I have prepared a piece of ground and brought over a quantity of cuttings from Arcot, and several of my friends mean to do the same. I shall at all times be ready to afford any assistance in my power to forward so laudable and public spirited a pursuit, and have the honor to be with high esteem,

My dear Sir,

Your most obedient and humble Servant,

(Signed) JAMES RAMSAY.

NELLORE, 21*st May* 1791.

Extract of a letter to Doctor Anderson from Mr. Chamier at Madepollum, dated 17th May 1791.

"The silk-worm eggs arrived safe and a great many have "already hatched. We have an abundance of mulberry plants around "us and several introduced into our gardens; so that I think there

"will not be any want of food. Mr. Dick purposes making a large "plantation and will, I dare say, prove a very spirited supporter "of your laudable exertions for the introduction of a silk manu- "facture upon the coast."

TO DOCTOR JAMES ANDERSON, MADRAS.

My Dear Sir,

In my garden within the Fort of Chingleput, are upwards of two hundred healthy trees, each nine feet high, from which the Collector may be supplied with a sufficient quantity of cuttings to form a large plantation whenever you may think proper, or if you will accept of my services and obtain from the Collector a spot of waste ground which I will point out, I will undertake to form and keep in order a plantation as a nursery, from which every village in this district may very soon be supplied with cuttings sufficient to form others.

Believe me,
My dear Sir,
Yours very truly,
(Signed) J. H. Skardon.

Chingleput,
23*rd May* 1791.

Trichinopoly, 16*th May* 1791.

I have received, My dear Sir, your friendly letter with the enclosure. I apprehend that the culture of the silk worm can be a matter of no difficulty and the experiment soon brought to the proof. This country abounds with the mulberry tree, and if the eggs could be conveyed with safety, we can soon give them a trial. What at any rate would accelerate success is that the task is a pleasing one independent of the advantages which may be derived from it.

I am dear Sir,
Your obliged and obedient Servant,
(Signed) Edward Garrow.

To James Anderson, Esq. *Physician General.*
Fort St. George.

TO THE HONORABLE SIR CHARLES OAKELEY, Bart.

Senior Member in Council.

Honorable Sir,

The great and unexpected fall of rain since the evening of the 21st Instant, (already equal to all the rain that in some seasons falls in both the months of October and November) rendering any attention to the watering of the mulberry trees entirely unnecessary from this time till the middle of March next.

I am to acquaint you that the Board of Revenue have written through the channel of their Rental General demanding payment of quit rent for my garden or assign a reason of non-payment which lies on their bound for some years past.

I have therefore been obliged to devise another method of which I hope you will approve, as it affords some prospect of accomplishing the ends I had in view of establishing the culture of silk.

The method simply is this, that you appoint assistants in General Orders to convey my directions and advice to all persons who choose to rear mulberry trees or cultivate silk, and that these assistants be furnished with a sufficient quantity of ground proper for mulberry plantations from whence they may distribute plants and insects.

In case you are pleased to adopt this plan, I recommend that Mr. Richardson, Surgeon at Ganjam, be appointed for Ganjam and the district, Mr. Haliberton, Assistant Surgeon at Vizagapatam for that place and the Cicacole Circar, Mr. Binny, Head Surgeon at Masulipatam for Masulipatam and the Island of Divi, together with the Circars of Ellore, Mastaphanagar, and Rajahmundry, Mr. Phippard, Assistant Surgeon at Ongole for that country and the Guntoor Circar, Mr. Richard Dighton for Nellore and the country of which he is Collector, Mr. Ramsay, Medical Storekeeper at Vellore for Province of Arcot, Mr. Stuart, Surgeon at Tanjore for that Kingdom, Mr. Edward Garnaut, Paymaster of Trichinopoly, for the place and country, Mr. Ogilvie, Surgeon at Madura for the place and country, and Mr. Martin for Palamocotta and the Tinnevelly country.

It will be necessary that each of these Gentlemen be allowed for Palankeen hire and twenty labourers to fence and lay out such grounds as you may commit to their care.

As a plan for such reports, as should be made to me, I enclose copies of letters from Mr. Garrow, Captain Mackay, Mr. Ramsay, and Mr. Binny.

I have the honor to be,
Honorable Sir,
With all due respect &c.,

FORT ST. GEORGE,
May 24th, 1791.

(Signed) JAS. ANDERSON.

Extract of a letter from Mr. George Binny at Masulipatam to Doctor Anderson dated 15th May 1791.

"Our land winds have not yet set in, but the weather is "hot and no rain, which circumstances concur in determining me "to postpone the planting of young mulberries from those now here, "but Mr. Scott and I have ordered ground to be got ready, and "Divy I think will be an excellent situation for them. The hot "land winds will not only be over, but it is to be hoped we shall "have a good deal of rain by the latter end of next month "when cuttings may be transplanted with a certainty of their "thriving and by that time, or soon after, I shall have a sup-"ply also from Hyderabad."

The regulations published at Turin by order of His Sardinian Majesty for the filature of silk, might serve to terrify more than instruct the people here, nor do I think that the delicate texture of the Indians will require a six years' apprenticeship as in Italy, but it may be useful to tell those who choose to apply to the filature, that the threads should cross each other fifteen or more times in their passage from the holes in the iron plate to the hooks of the goer and comer, for moulding the filaments of which they consist into a compact body together.

I am with all due respect,
Honorable Sir,
Your most obedient and very humble servant,

FORT ST. GEORGE,
May 28th, 1791.

(Signed) JAS. ANDERSON.

Mr. Mein, Head Surgeon at Trichinopoly, writes me there is an abundance of mulberry trees and plenty of proper ground at Worriore in the neighbourhood of the General Hospital, and hopes to be honored with the station of Superintendant, which may be done without prejudice to Mr. Garrac, as too many plantations cannot be made at so populous a place, the capital of a rich district and station of a Brigade, where such plantations may likewise become useful in rearing vegetables for the sick under the shade of the mulberry.

I have the honor to acquaint you, that I have delivered forty mulberry cuttings each (being the same number issued to the other villages I have mentioned) to Poonapa, head man of Vassaravady, Verdapa Moodelier of Tandiarpettoo, Cundapa Moodelier of Corimbakum, Bidneddy of Vingumbakum, Poonambully Moodeliar of Arumbakum, Commara Pilly of Uroore, and Armoogam Moodelier of Peelioor, which will be sufficient to supply cuttings for a lange plantation at each of those villages, as soon as the ground is dry enough to be worked after the November rains.

I am,
With all due respect,
Hon'ble Sirs,
Your most obedient &c.
(Signed) JAS. ANDERSON.

FORT ST. GEORGE,
June 3rd, 1791.

TO THE HON'BLE SIR CHARLES OAKELEY, BART.,
Senior Member and Council.

HONORABLE SIRS,

I am favored with your letter of the 8th instant, and have the honor to enclose a copy of my correspondence with Doctor Berry for procuring proper persons from Bangalore to wind off silk, which at any rate you can be at no loss to establish, by a few such people on the first ships of the season from Bengal, who likewise understand how to fold up the skaines in proper manner.

Having satisfied myself in all these particulars on a small scale at my own garden, I should be very happy to superintend an

academy on the plan you so properly recommend for well ordering the silk manufacture but really my other avocations will not admit sufficient leisure.

The quick and ready perception of the filament, to begin winding the Cocoon is the only difficulty, and I know of none more likely to be possessed of the senses of sight and touch in perfection, than the young learner at the Asylum.

Could the Governors, and Governesses therefore be persuaded to forego the idea of educating ladies maids, you might consider this charity as a sufficient Establishment for the filature of Madras and its environs conformable to the practice in Italy; and the young learners would thus acquire the possession of an Art sufficient to preserve them independant through life. For the reason I have above assigned it will not be practicable for me to attend to the immediate management of any plantation of mulberry trees beyond my own garden, but I will endeavour to discover and recommend to you as many proper persons for this purpose, as will supply the Inhabitants of the Black Town and bounds here with abundance of leaves.

What silk I have wound off has been by the use of tepid water without killing the grub, from whence it appears there is less gum and filth on the silk here than in more northern climes, but where the filature is established it is said that the grub must be killed by putting the Cocoons in an oven, to prevent the moth escaping and spoiling the silk.

In all the present known filatures, the Cocoons are wound off from boiling water which I think must in some degree injure the texture of the silk, and it would be of consequence to establish the filature without the use of fire, as well to save much expence of fuel as to avoid revolting the minds of Bramins and teachers of the transmigration.

On a revisal of the letters I have had the honor to address you I find them a perfect plan till this stage of the business and having conceived some amendment practicable in the filature, it is not my intention to obtrude an established mode till the points I have alluded to are more fully illustrated.

You may therefore depend on my further observations on this part of the subject in due time, having the honor to be,

With all due respect,

Honorable Sirs,

Your most obedient and very humble Servant,

FORT ST. GEORGE,
June 10th, 1791.

(Signed) JAS. ANDERSON.

HON'BLE COURT'S LETTER, *dated 19th September* 1792.

79. We have received great pleasure in the perusal of the correspondence to which you have referred us relative to the culture of mulberry trees, the introduction of silk worms and the consequent manufacture of silk upon the coast of Coromandel. We desire you will inform Dr. Anderson, that we entertain a proper sense of the zeal he has shewn, and the endeavors he has used, in the pursuit of an object which must be considered as of great public utility. We notice with much satisfaction the encouragement you have given to this undertaking at Dr. Anderson's recommendation, and we wish to know his opinion in what manner the undertaking so apparently beneficial can be aided from Europe. In the only country where according to Dr. Anderson's representation the insect continues in full perfection throughout the year, as well as the tree on which it is fed, it is natural for us to form sanguine expectations of the ultimate success of a plan, which will not only be productive of great commercial advantages but which is to give employment to the inferior classes of the natives, and thus increase the population of the several districts under your government a very favorable report has been made to us upon the two samples of silk transmitted by the "Leopard" man of war and we wish to receive an account of the number and extent of plantations already made, the number of persons employed and the quantity of silk that has been produced.

80. We are sorry to find by your proceedings recently received that any misunderstanding should have arisen between Dr. Anderson and the Board of Revenue, especially as it seems to have had the effect of damping his ardour in the pursuit of the object in which he was so laudably engaged. Mr. Spencer Corbet who was so recommended by Dr. Anderson to superintend the

winding of the silk addressed you pretty much at large upon the subject on the 18th August last, but it does not appear (we suppose an account of the hurry of the dispatch preparing for the Swallow) to have been taken into consideration. Every reasonable degree of encouragement ought certainly to be afforded to a project pregnant with so many advantages.

81. Dr. Anderson's letter on the subject of the nopalry will be submitted to the consideration of Sir Joseph Banks, and due attention will be paid to the hints herein suggested.

20. Having the highest opinion of the zeal and abilities of Dr. Anderson, in the various pursuits in which he is engaged we yield with pleasure, to your recommendation, in relinquishing the Company's claim upon him for Quit Rent on account of ground in his possession near Madras.

CHARLES NORRIS, Esquire,

Chief Secretary to Government.

Sir,

I most respectfully beg leave to acknowledge the receipt of your letter of the 22d ultimo, informing me that the Honorable the Governor in Council has been pleased to grant me the remaining moiety of the village of Pospowly together with the small village of Toongawan, and that the same was to be included in my Lease of the Powey estate, all the waste land being exempted from assessment for the same period as is usually granted to other landholders in Salsette for all which kindness, I beg to offer my highest acknowledgements to the Honorable the Governor in Council.

For the information of the Honorable the Governor in Council I beg leave to subjoin an extract from this lease, and I shall then proceed to point out the several improvements which have either been undertaken and completed, or are now in progress of a lease bearing date 5th Sept. 1829 and signed by G. Giberne, Esquire, Collector of Northern Concan.

2nd. "Paragraph. Erect buildings, sink tanks, and wells; build "embankments of fields and introduce the cultivation of superior "articles of produce and extend the present cultivation, should "you not attempt any of the improvements above mentioned within "the period of 10 years, the Government is at liberty to resume "the grant, after that time of ten years, should you expend any "capital in buildings &c., as above, the grant of the villages and "lands will be considered confirmed to you and to your heirs "assigns &c., in perpetuity. You will make annual reports to the "Hoozoor of whatever improvements you have made during the pre-"ceding year which the Collector will inspect."

It will be seen from the foregoing extract that the possibility of any very great or general improvement was not looked for before ten years. The land when I took possession of it in July last was either waste or under common paddy cultivation—a thick jungle covered a considerable portion of the waste, and the remainder was overgrown with grass. In the month of December, I first commenced the improvement which I had projected and which I am desirous to state even thus early in order to convince the Honorable the Governor in Council that I have taken some pains to fulfil the intention of the lease, the order of these improvements was as follows:

1st. I began to cut the branch of the Tannah road which runs through my estate, and extended to and through the village of Toongavan, my more recent grant, so that carriages of all descriptions can now pass to Powey, and the other my villages. The road is at present in very tolerable order, but requires a further supply of good materials to render it hard and firm, and which I hope to get laid down before the commencement of the monsoon. Next year I contemplate carrying on the road from Powey to the river wharf through the village, a distance of about two miles. The total expence of this primary improvement will be between five and six thousand rupees.

2nd. I have began to build a substantial and commodious house suitable to the extent of my property with out-houses &c. In two months more I hope to complete it, and the expenditure on this account will be at least six or seven thousand rupees.

3rd. In the waste lands of Powey and the other villages I have dug twenty-three wells, and am to build them up of the most substantial materials, the whole being of stone and chunam, on an average each well will cost me a thousand rupees, so that when they are all completed, which I trust will be before the monsoon, twenty-three thousand Rupees will have been expended on this head.

4th. Before attempting to introduce the cultivation of superior produce I offered to the inhabitants to make them advances if they would grow Sugar Cane &c., but they all declined, stating that they were only acquainted with the cultivation of Paddy &c. However being desirous that they should make the experiment, I have given a certain portion of the waste land to them with 4 wells, and advanced two hundred rupees for each well making altogether 800 rupees under a promise that they would attempt the cultivation of sugar cane.

5th. I have already brought down and established families from Cutch and other parts wherever I could find clever, intelligent persons. Their attention is first of all to be directed to the plantation of sugar cane and of fruit trees. My advances to them have been made according to the number of Wells and at the rate of 200 Rupees for each well. By their agreement they are bound to dispose of the sugar cane to me at the usual market rate, in order that I may be enabled to commence the manufacture of soft sugar. I intend shortly to commence building a manufactory for this purpose, I have already in my possession Iron mills, and I hope to have the house completed, the mills erected and the whole in a state of readiness to commence the undertaking when the Sugar Cane is ripe in October or November next.

6th. In addition to the above I have likewise planted Sugar Cane on the large tract of waste land and have commenced preparing the land for Indigo, on this latter account I wrote to Calcutta to engage a proper Superintendent, and my friends there have sent round to me a Portuguese named Ricardo Carro who is said to be well acquainted with the whole process, both to the cultivation and manufacture of the articles, I have engaged to pay

him 75 Sicca Rupees or 82 Bombay Rupees per mensem, commencing from the month of December last, he arrived here on the 23rd March, and I shall commence immediately erecting a good house to receive the large tanks, Press screws, and all the other necessaries for a perfect manufacture. I am daily expecting a supply of the best Indigo fresh seeds from Calcutta.

7th. I have moreover planted out a number of mulberry trees for the purpose of attempting the growth of silk, and have engaged two Persians, who profess to be acquainted with the mode of rearing the silk worm &c. I cannot, however, but feel apprehensive, that from the difference of climate, their efforts may not be so successful as I could wish, and having lately heard from my friend G. Giberne, Esquire, Collector of Poonah, that there are confined in the Poonah Jail some persons possessed of silk worm's eggs, and acquainted with the method adopted in Bengal, I should feel greatly obliged if the Honorable the Governor in Council would grant me an order to enable my people to have access to these convicts, and not only profit by their experience, but obtain for me the requisite supply of eggs.

8th. I ordered this season from Malacca 300 nutmeg and clove plants to be brought on in my ship Golconda, but unfortunately only a few of them arrived alive and in a proper state. I have also procured from the same place many different cuttings of valuable fruit-trees, such as the mangusteen, Dookoo &c., and 50 plants of the sweet orange from China, which I intend to put into the ground before the commencement of the monsoon. I am expecting from Mocha about 100 Coffee slips, and from Calcutta, I hope soon to receive a supply of fine table rice as seed, and from Surat, I have obtained some fresh commode rice, as seed for the like purpose, from Malabar I am endeavouring to procure black pepper, cardamums, and sandal wood, my object being to introduce on my estate all the best and most valuable produce of every kind.

I trust from the above detail that it will be apparent to the Honorable the Governor in Council, how anxious I have been to make every possible improvement, and that the greater portion of

what was looked for in 10 years has been accomplished in six months. In January 1831, I hope to have all my improvements so advanced as to be able to submit them to the inspection of the Collector, agreeably to the terms of my lease, my exertions will not be limited to what I have already accomplished or undertaken, and I shall go on sinking wells and making other beneficial changes as far as lies in my power, bringing the same to the notice of the Honorable the Governor in Council, and entering into such particulars as may appear useful.

I have the honor to be, &c.

(Signed) FRAMJEE COWASJEE.

BOMBAY, *6th April* 1830.

No. 262 of 1830. TERRITORIAL DEPARTMENT, *Revenue.*

To THOMAS WILLIAMSON, ESQUIRE,

Secretary to Government, Bombay.

SIR,—1st. I have great pleasure in forwarding the accompanying copy, of a communication with its translation to be laid before the Honorable the Governor in Council.

2nd. The specimens of silk accompanying the same, I returned according to the express wishes of Mr. Mutti, and for the purpose stated, they will eventually be forwarded for the inspection of Government. I cannot take upon myself to say that I am experienced in this subject, further than in the elementary branches, to which however I have, both in Candeish, where I introduced the culture of silk, and elsewhere, bestowed considerable attention, the Report of the Agricultural Society will be the most satisfactory, and I have no doubt it will do ample justice to the zeal, ability, and perseverance, of this Gentleman. To the qualities I can afford my testimony, and I feel confident, from the success of this, his first attempt, in assuring the Honorable the Governor in Council, that the greatest encouragement to this Gentleman will not be thrown away.

3rd. I now look forward with the greatest hopes to the success of Mr. Mutti's undertaking, and the result will be of such

paramount advantage to this country in particular that I should respectfully recommend the greatest encouragement being afforded to them; he expresses a wish for a grant of land in the 5th Paragraph of his letter. I humbly conceive that this would be well bestowed: to attract such characters to a country is of the first importance, and now that fortune has bestowed what I may call, a gift, I trust Government will forward his views and entice him to remain and continue his good work to the utmost: what a field does this lay open in perspective: supposing the culture of silk succeeds as we may fairly anticipate, it will lay open another channel for commerce, we shall most assuredly throw out the demand for Persian silk in the market, we may equal the quality of the silk of Italy, and if so, we undersell it in the London market, for in the latter country the advantages in producing it are not nearly equal to those in this country. In the former, silk is produced but once in the year, here in every season.

4th. In contemplating what the result of this undertaking may produce to this part of the country, I may perhaps be carried beyond the sober bounds of reality, but as a man drowning, seizes at a straw, I would also seize at the most feeble chance of improvement to a country such as this. The prospect now opening however is not so much enveloped in mist, but that we may clearly define a moderate advantage. I look forward however to its success as certain if the Gentleman is encouraged and will persevere; in progress of the measure many hands are employed, if at the end, success crowns it, a staple of value will not only give employment to many, and tempt others to the undertaking, but a return either in money or commodities must ensure, and this city will derive no ordinary advantage.

(Signed) GEO. GIBERNE, *Collector.*

COLLECTOR'S OFFICE, POONA, 19*th May* 1830.

To MONSIEUR GEORGE GIBERNE, *Collector, Poona.*

SIR,—1st. I have the honor to transmit certain specimens of silk which I have spun at the Kothoor Bagh, as follows:

1 of 3.4	Cocoons	sublime yellow.
1 of do.	do.	do. white.

1 of do. do. do. Satin.
1 of 4.5 do. of the 1st quality do.
1 called Trine common do.

2nd. You are aware, Sir, of the very bad quality of the cocoons which are produced in the Jail. I therefore look to your favorable consideration of the result, at the same time I beg to call your attention to the equality and cleanliness of the silk as likewise of its great pliability.

3rd. I feel also the greatest satisfaction in forwarding four more specimens of a new kind of silk. Mrs. Spiller's silk, which I have spun also at the Kothoor Bagh, it is produced from a kind of cocoon found on the Bere tree as well as other shrubs which grow in great abundance in the jungles as well as in the gardens at Poona, Salsette, and Bombay. I have hitherto not paid much attention to the improvement of the color of this silk, nevertheless there is a great difference observable in this respect between the 1st and 4th trial, consequently I look to the future improvement of it without much difficulty.

4th. I take the liberty, Sir, of requesting you to have the goodness to bring to the notice of Government that I have thus commenced the manufacture of silk, and that I have made the before-mentioned discovery which must doubtless prove most interesting from the probable results.

5th. I trust that Government, considering its goodness, will accord a reward, and should my hopes in this respect be realized, I would beg a grant of land at Poona which I should much prefer to a gift in money. Government may regard me as its creature, and it may be satisfied that nothing shall be wanting on my part to meet its wishes with gratitude, zeal, and activity.

6th. As I have no other specimens of the silk before mentioned, from the temporary cocoons, I beg of you, Sir, to have the goodness to return them after examination, as I desire to present them before the Agricultural Society at the approaching meeting on the 25th proximo, of whom I shall beg the favor of their being transmitted to Government.

(Signed) G. Mutti.

(True Translation,) (Signed) Geo. Giberne, *Collector.*

Poona, 18*th May* 1830.

To THOMAS WILLIAMSON, Esquire,

Secretary to Government, Bombay.

Sir,—I have the honor to acknowledge the receipt of your letter of the 22nd ultimo, intimating that the Honorable the Governor in Council being desirous of obtaining information regarding the silk manufactory, particularly what quantity of silk I expect to produce in the Salsette at Poway with its estimated costs, and selling prices, and in reply of which, I beg to state for the information of the Honorable the Governor in Council, that the silk manufactory at my Poway estate, I have only commenced from July last, but some time previous to which I had planted about 2,000 mulberry trees in order to preserve the lives of the worms by feeding on the leaves of those trees. Since July last, I have commenced with the manufactory of the silk, and have paid about 520 rupees to the Superintendents &c. &c., including the other costs.

The produce of the silk is very little, which I am sorry to say about 2 lbs. valuing ten rupees. The silk which producing are of 3 different sorts, the first, second, and third, and they are selling in Bombay, the first sort at 11 rupees, second 10, and third 9 rupees per a pucca seer (15 pucca seers are equal to 28 English pounds).

I am however anxious to continue the silk manufactory, and I think it my opinion that after two or three years when the mulberry trees will increase in numbers about 150,000 or more, in the separate 8 or 9 divisions containing about 15,000 trees in each of the divisions, to use for every 42 days when the worms begin with the new crop of the silk, which will enable me to get a considerable leaves for the sufficient preservation of their lives. The climate of this island is not cold enough for them and in consequence of which they cause to die very soon. The worms finish their twisting say within 42 or 45 days and by this consideration it will produce about 8 or 9 crops in every each year.

I think there will be necessity to occupy 100 Beegas of ground, for the purpose of raising the above-stated mulberry trees, and which may require 33 wells for providing them with water,

which will cost as follows, viz. The rent for the ground is payable at Salsett, say for 33 Moorahs of Batty ground, (equal to 100 Beegas) at 20 rupees per a moorah, which will be amounting to rupees 700 every year, so the consideration appears much higher at Salsett than the Deccan. Revenue for each well will be 50 rupees, but it will cost, say viz. 1 pair of Bullocks, monthly feeding for them, 1 leather moth for drawing water and 2 men absolutely be required on each well.

The above expences will be estimated for nearly 8 months on each well amounting to rupees about 300, and 50 rupees more will be incurred for the Superintendent, and other servants be necessarily required in the branch of that work, which will make the grand total 350 rupees on each well and on 33 wells after their completions in 2 or 3 years, there would be incurred annual expence 10 to 12,000 rupees.

The amount of expence which will incur for the above 15,000 trees for the use of getting an abundance leaves for the sufficient providence to the worms in one of eight crops of the silk and I dare say the cost of which would be realized by the sale of it. I am anxious to continue the silk manufactory provided, that if there should be any chance of recovering the expence which I may incur on it, even with an allowance of small interest of about 5 or 6 per cent. on the capital that I may be obliged to lay out on this occasion, and the same I will in future with the greatest pleasure bring to the merciful information of the Honorable the Governor in Council.

I have begun to manufacture the Indigo by the Superintendency of a Portuguese, brought out on purpose from Calcutta, on a monthly salary of 75 rupees, and besides him several other persons employed in the said employment. I really think that I have expended about 3,000 Bombay rupees for erecting the manufactory screw, &c. and nearly 1,000 rupees paid for the wages of the Superintendent, say for 12 months, total rupees 4,000, and under such arrangements, I am sorry to say, that I have sustained a total of loss, as the crop of it was washed away by the heavy fall of rain in the past rainy season, also in the month of

August last, there was cut one crop of Indigo which was totally spoiled from the want of its taking colour, and it has therefore caused no produce of a single rupee, notwithstanding I am anxious to continue the manufactory of Indigo with a great care in future, but I am waiting only to sow the new seed until its arrival from Guzerat, and of which I shall willingly bring to the favorable notice of the Honorable the Governor in Council.

I had already planted numerous Sugar Canes in last year, in the 40 Beegas of ground which have been produced beyond my expectations and am therefore sowing the seed of them now I am very glad to try to make the Jagry, and by which to get the soft sugar to be made, by which requires an experienced Superintendent, whom I expect one from China on my ship Golconda who I think easily can do it, but again I am afraid that the price of the soft sugar was several years ago in Bombay from 5 to 6 rupees per a Surat maund, which is at present much reduced to about 3¾ per maund, and at which rate I imagine it will not realize the amount that will incur for such improvement, yet I am endeavouring to carry on with it in some different project that I intend the sugar juice should be mixed with the brab toddy, and wet date, and then to distil it in the similar manner as formerly was distilled the Rum, or Arrack at Bhandoop and Poway.

There are great many numbers of superior fruit trees, brought from different places and have been planted at Poway, (viz.) Mr. Young supplied from Aurungabad with some plants of santra, cumbla, orange, vines, and peaches, and besides these, I have received from Amboena via Singapoore a great quantity of the plants of nutmeg, cloves, and other different kind of fruit-trees.

I expect to receive from Malabar a large quantity of trees of black pepper, and sandal-wood which will be planted at Poway.

There are also planted a considerable trees of goaver, plantains, pompunose, limes, pineapple, &c. &c. The potatoe seed which I have received from Neelgherry Hill have been planted and are raised well.

(Signed) FRAMJEE COWASJEE.

BOMBAY, *9th December* 1830.

TERRITORIAL DEPARTMENT, *Silk.*

To THOMAS WILLIAMSON, ESQUIRE,

Secretary to Government.

SIR,—The attention of Government and the community having been lately called to the subject of producing raw silk for exportation, I have the honor to offer a few observations. In the Deccan, mulberry plantations, and silk establishments are now forming at the Kutroor Bagh and Phoolshurh near Poonah, at Ahmednuggur and at Secroor, at the Honorable Company's Botanic garden at Dapooree a plantation of mulberries of several acres has been made for the purpose of distributing cuttings and eventually of breeding worms, in the Southern Mahratta country silk has for some time been produced in small quantities near Darwar, Hooblee and Raneh, Bednore and some leases have been granted to natives for mulberry cultivation. The silk now produced in these several places is sold on the spot to the native manufacturers. The establishments are capable of great extension and the article of much improvement in various ways.

If any doubts had existed as to the policy of encouraging this produce for exportation, at any risk or expence to Government, or individuals, they must be put an end to by the perusal of the evidence which has lately been given by experienced persons in England in an examination before a parliamentary Committee.* From this evidence it appears that an extension of the growth of silk in this country is necessary for the interests of the British silk trade. It is pointed out that the articles must be improved by additional skill in preparation, while it is thought hazardous to attempt innovations in the Bengal factories, for fear of diminishing the quantity, or raising the price of an inferior silk, so necessary for enabling the British manufacturer to compete with foreigners.

It is stated besides that an elevated situation and moderate temperature are more favorable to the worms, than low marshy countries which circumstances form an additional encouragement to the choice of the Deccan and Southern Mahratta country, as the

* See evidence by Mr. S. Wilson and Mr. E. Durant before the Committee of the House of Lords—the E. I. question.

fields of experiments, for attempting to produce the finest silk; as these countries approach nearer than most other parts of India to the climate and clear sky of Italy. The evidence goes to prove (and we know no reasons to the contrary) that silk of the finest quality and highest price, would be produced in this country, if the people could be taught to reel it after the Italian method, provided always, that proper attention be paid to breeding and feeding the worms, means that might readily be placed within our reach. It appears that the chief difference between good and bad raw silk is caused by the degree of manual skill employed in the filature—now this superior skill not being found in Bengal, and considering that no one recommends the Bengallies to alter their process, lest the quantity of silk produced should decrease, it necessarily occurs that it would prove advantageous to introduce filatures on the most approved principles on this side of India.

These considerations have no doubt by this time been presented to the attention of the Honorable Court of Directors, who will certainly be desirous of encouraging any measures which may tend to the wished-for result of rendering England, by means of India, "the mart of the world for silk."* Now should it be made known by Government to the Honorable Court, that silk establishments are now forming and that in several places they are sufficiently advanced to enable us to put to the test, the proposed improvements, we may trust that the means of carrying them into effect, will be readily afforded. I will therefore take the liberty of briefly enumerating our desiderata.

It would be tedious at present to state *why* it is desirable to obtain young plants and seed (dried berries) of the *Italian* white mulberry, but it would be very satisfactory, and would put an end to the doubts of many practical men, which cannot be set aside in any other way. I will take another opportunity for reverting to this subject in explanation. In the mean time I beg to request that Government will be pleased to procure for the Honorable Company's Botanic garden at Dapooree, a few cases of young

* Vide a printed paper containing valuable information on "raw silk" signed "Dover and Norton London."

plants of the white mulberry tree from Italy or France. The black mulberry (the species common in England) being unknown in this part of India it would be desirable to introduce it. It would be an useful auxiliary to the other kinds. Besides these, any other species from any part of the world (seed or living slips) will be very acceptable, as they will enable us to come to a proper understanding of the qualities and characters of the several species, or supposed species, a subject which is at present in considerable confusion.

The silk at present produced readily sells in the Bazars at a sufficient profit, having the advantage over imported silks of the difference of freight, carriage and duty to compensate for its inferior quality. This inferiority must necessarily continue unless the reelers have the advantage of instruction from Europe—at present the filatures are conducted in a rude way by very unskilful people, and the utmost improvement that can be expected in the ordinary course of things, is an approximation to the quality of the Bengal staple.

I am encouraged therefore by these considerations, confirmed by the opinions expressed in the course of the evidence above alluded to, to submit to Government the expediency of procuring from home some persons either English or Foreign *of the Mechanical Class* who are practised in the finest processes of reeling. They might be furnished with some of the most approved kind of reels, and be employed in instructing Natives and others, in the newly established filatures, in the mode of working the finest raw silk for the English market.

These undertakings would be much benefitted also by occasional supplies of the eggs of the annual Silk worm from the South of Europe; and we shall be thankful for copies of the best Works published on the subjects of silk, mulberries &c. in England, France or Italy, models and drawings of the best implements and machines connected with the filature and information of every description.

(Signed) C. Lush, Supt. H. C. Botanic Est: Dapooree.

Nowlgoond near Darwar, *7th January*, 1831.

To MAJOR ROBERTSON, *Principal Collector, Ahmednuggur.*

SIR,—In going on with my operations of rearing trees and introducing a more efficient plan of feeding the worms and improving the reeling of the silk, I conceive my success is an object of so much importance for the good of the Country, that I deem it my duty to trouble the Right Honorable the Governor in Council with a report of the progress I have hitherto made.

My labours since obtaining the grant of the Furrah Bagh Lands in July 1830, have until lately been directed to planting the small mulberry, which is, I believe, the Morus indica: it has a small berry and in favorable soils throws out a pretty good sized leaf, which is sometimes indented sometimes not, and is the same, as far as I can understand, as that used in Bengal where it rises as in this Country from 6 to 10 feet high. This was planted in close hedge rows as in Bengal, and when it had attained the height of 4 or 5 feet, every alternate row was taken up by the roots and carefully planted at regular distances of 12 feet square, on other spots of ground this was thought to be favorable for ploughing and harrowing in every direction round the Trees, and to be a great saving of manual labour which could not be avoided in the close rows: about 12 or 15,000 trees were removed in this way. It was found, however, that while the trees were placed at such distances, there was an useless expenditure of water by flowing over the vacant ground between each tree. This vacancy was therefore filled in with cuttings, so as again to form them into hedge-rows at 12 feet distance, the intermediate space being well ploughed, but now only in one direction, and sown with grain (or other low grains which do not rise high to injure the trees) so as to leave 2 or 3 feet on each side of the row perfectly clean—this was intended to make the ground pay and at the same time the most economical plan of watering and keeping the trees clean. The reason for persevering with this kind of mulberry was, that the leaf seemed better adopted for producing a fine kind of Silk having more of the resinous and saccharine, and less of the fibrous part, than the Morus rubia, which has a long fruit with a large, coarse, deeply indented leaf, and thus in proportion to the weight of the leaf the small Mulberry would hold a greater quan-

tity of Silk than the large, and also of a superior quality. I am sorry to say, that this kind I now find is not adapted to this soil, which, in most parts, is of a black and hard nature into which the roots of the small tree cannot penetrate with facility. I have therefore lately directed my attention to a kind of Mulberry intermediate between the large and small and which my head Chinaman informs me is the best in the country: it grows into a pretty large tree. Within the last 15 days 800 trees have been transplanted of this kind, and to give them every chance large holes have been dug and filled with white earth and manure, so that the roots may acquire strength and nourishing enough from the rich light soil, to enable them to penetrate the black and denser soil: some I have tried with manure without any white earth. One field of this kind is laid out in hedge-rows with 12 feet distance, and as these acquire a sufficient height they are transplanted, and in the course of two or three years, may grow into trees.

There are also about 60 trees of this kind coming on which have been budded upon the small and also about 10 of the large coarse leafed on the small which were tried to ascertain what alteration it might make on the leaf. Some cuttings of the Morus alba were obtained from the Village of Jamgaum, where there are four or five trees growing luxuriantly and of a great size upon a variety of the black soil, one plant of this kind and a species of the Morus indica growing at St. Helena together with the Doppia Foglia of the Italians are growing very well. These were received from Dr. Lush at Dapooree.

About 60 beegas are under mulberry cultivation, but being mostly of the small kind for which the soil is not so favorable, the leaf is not very large.

The disadvantages under which I labour are these. The adhesive and hard nature of the soil, consisting of a very great proportion of alumina without any silicious earth to keep it open, and consequently its great absorption and retention of water which by evaporating from the surface causes a sudden contraction in bulk, when the soil splits into fissures and exposes the roots of the Trees. The exhausted powers of the land in consequence of continued irri-

gation by the Koonbees who formerly cultivated the lands, and its abounding with spontaneous grasses called Hurralee and Roonda, which give us incessant toil and trouble: they run under the ground in every direction to the depth of 4 feet or more, and have roots about the size of a writing quill and joints from which other roots strike out. These often form a complete basket work round the roots of the trees and bind them so that they cannot expand, scarcely has one piece of ground been well cleaned before another from the frequent watering, is over run with these grasses which are continually re-appearing, being supplied from the roots at a great depth.

These are the peculiar disadvantages which I have to combat in regard to the rearing of trees on which almost entirely the success of my undertaking depends. I am endeavouring to overcome them by every means in my power, so that the natives may perceive the possibility and advantages of raising silk in the Deccan. I am happy to be able to state, that several Natives have begun to form plantations.

The Palace of the Furrah Bagh, which Government allowed me to occupy and which was in a most dilapidated state, has been repaired at a considerable expence—a passage has been made across the tank, and feeding rooms fitted up exactly on the plan recommended by Count Dandolo. This extensive building from its coolness, being surrounded with water and the large accommodation it affords, is admirably adapted for feeding rooms for a large tract of country.

A bungalow has been built in which I live on the grounds, with stabling for bullocks &c. so that in the morning when I have performed most of my duties as Civil Surgeon, I may be on the spot to superintend what is going on.

The reeling of the silk is conducted by two Chinamen, one of whom receives 48 Rupees, and after his period of service has elapsed, his passage found him back to China, and the other 16 Rupees per mensem. They have a most simple winding machine which they brought secretly with them from China, a plan of which is affixed to this report. The most approved English machine,

that could be procured in London, has been sent to me, and the one used by the Italians, but neither of them is adapted to make the reeling a domestic operation like the simple China one, which requires only one person to manage the whole, and may be used by the Hindoo or Moosulman women in any of the corners of their hutts or houses. The silk Throwsters (who throwst the raw silk imported in quantities from China for domestic manufacture of cloths) have brought their women and sons and learnt under the Chinamen and would not receive any wages from me until they were expert enough to be regularly employed, so desirous are the Natives of acquiring the art of reeling.

The quantity of pure Silk from my cocoons is 1-11th of their weight, the same proportion as in Italy and much greater than in Bengal.*

There will be no necessity for my entering into any particulars regarding the mode of feeding and reeling, as the former is so well laid down by Count Dandolo, and the latter can be acquired by practice.† I may however mention the China Tatty on which the worm spins, which is 2 feet broad and about 4 feet long, is formed of bamboo twisted into loops. The worms are thickly placed among these loops and exposed freely to the open air, which renders the cocoon harder and dries the watery or serous fluid which the worm throws out in such quantity as it is spinning.

The first crop of worms in November last yielded about 8 lb of silk, there was a great mistake made in having calculated too small a quantity of leaves to the Vox kept for the crop. The consequence was that worms having been badly fed in the latter stage,

* The Hon'ble And. Ramsay stated in his examination before the Select Committee of the House of Lords April 1830, that the quantity of Spun Silk produced from the Maund of Bengal Cocoons of 80 lbs. yielded only about 4 lbs. of Spun Silk, or ¼a twentieth part, but I should think that there must be some mistake in this, because Dandolo sometimes obtained 1-10th in Italy and the average of this Silk mills was 1-12th. In the more favorable regions of Dalmatia rather more than the latter proportion was obtained, and which he thinks as owing to the leaf as his experiments tend to shew, being more nutrative in warmer climates.

The proportion of pure spun Silk obtained at Nuggur is as mentioned 1-11th not including the coarse which if included would give a proportion of 1-8th to the weight of dried Cocoons.

† What is called the staple of the Silk is given in the reeling, which it never loses afterwards. Without this, the Silk would prove of little or no value, as it could not throwsted and afterwards made into the warp—The Natives could never acquire the art without being taught it by the Chinamen.

the cocoons were soft and small nor could we judge of the quantity of leaf consumed to the silk obtained. I have the honor to forward 2½ lb of silk as a specimen. Until the present trees grow up above a few pounds of silk cannot be expected from each crop: the second is now in progress.

The Natives offer me the same price as for the China Silk, 14 or 15 Rupees per Nuggur seer, this will pay almost as well as sending it home and give me a quicker return. Probably I may hereafter find it advantageous to give out the cocoons, and have them reeled in the Native houses at so much the seer; and by having the very simple native throwsting machines erected in the palace, I may save the profit which the Boras have in the raw material passing through their hands before it reaches the throwster and weaver.

It may prove interesting to mention what information I have received from the head Chinaman, regarding the mulberry trees, Silk and the varieties of the worm in China, but I cannot vouch for its correctness as he does not properly understand the native language and it is the only one through which we can communicate. In China all kinds of mulberry generally grow in hedge rows and are cut once every year in the cold weather (January), level with the ground. White earth, sometimes taken from the bottom of a tank, and manure being applied, the hedge-rows continue to throw out leaves luxuriantly during the whole rainy season which lasts 7 months—the rain commencing about the end of February and falling for 2 or 4 days at different times in each month. Should the rain not fall the trees are watered by the hand from a tank or well in the midst of a plantation. These plantations cover a large tract of country and are kept very clean, the leaves are brought from the distance of two days march and sold in the nearest market, at an average of 3½ Nuggur maunds or 140 lb for a Dollar (Rupees 2¼); these leaves are purchased by the feeders of the worm who keeps them on large round baskets placed at small distances one above another on stands. They are fed 6 times in the day, and 4 times during the night. After feeding, a cloth is put round the stand, and the feeder again goes into the market to purchase fresh leaves.

The reelers purchase the tattees (such as I have mentioned on which the worms are thickly placed for spinning) from the feeder. The reelers get about 6 pice daily, when the cocoon is given out, and will reel about 1 Rupee's weight in the day, but work only till 4 o'clock. They have 3 kinds of worms in China —the largest is said to be, when fit for spinning, about 3 inches long, of a black colour, and 3 crops of a deep yellow coloured silk can be produced from it in the year—this worm (which is the most expensive) is sold at 2 Dollars (Rupees 4 8) for 4½ tatties—these 4½ tatties of worms will have consumed 4½ nuggur maunds of mulberry leaves in their progress and from this quantity 1 seer (2 lb) of spun silk is produced the cocoon produced from this worm is about 2½ inches long and 2 in circumference, and yields the silk of the strongest fibre: the Chinese head cloth are fomed from it. The second worm, producing the white silk, is pale coloured and extensively fed in China—it is smaller than any of the others and completes its stages in 20 days. The third kind, producing a yellow silk, resembles the worm we have in India, but the fibre of the silk is stronger, it completes its stages in 23 days, 4 maunds and 20 seers (180 lbs.) leaves are required to feed 7 tatties of the white worm, and rather more for the 3rd kind; 7 tatties are bought for a Dollar, and will produce about 1 lb. of fine spun silk. From the two latter kinds 6 crops in the year can be obtained.

The Chinaman brought up with him one or two of the large China silk worms' eggs, one of which, a male, came out and was a most beautiful moth, exactly resembling the handsome atlas moths, only smaller which we have in the Deccan—the Phalæna Paphia, of which Dr. Roxburgh gives a description, and from which the Passah silk (so much used by the Brahmins) is made in Bengal. I applied to Framjee Cawasjee in Bombay for a supply of eggs of the 3rd kind of worm* which the man

* I suppose this may be the same species that was introduced into Bengal in 1788 called the China or Madrassee worm, the Cocoons of which were at first good, but having been given to the cocoon Cultivators, their quality soon degenerated, owing to carelessness and want of proper feeding. On enquiring at the Chinaman why he did not bring the breed of the large or white worm, he says that he would not have injured his Country by bringing them

had brought out from China and left with him, but received no answer to my application, had we succeeded in procuring them the fibre of the silk would have been improved, but I rather think that the Parsees, from few of them being landed proprietors, and being entirely a commercial people, would not be desirous of encouraging silk in the Deccan, hitherto we have had nothing but the common Country worm.

I can see no reason why the silk should not succeed as well in the Deccan as in Italy where they have only one Crop of leaves in the year, while in this Country the Mulberry being in constant vegetation, we can have, without injury to the Trees, at least six Crops in the year. In Italy they are obliged to have recourse to artificial heat while the worms are feeding. Here we are under no such necessity; yet, notwithstanding their disadvantages, silk is the great source of the national wealth of Italy, and gives employment to many of its inhabitants in supplying the raw material for the fine English manufacture of ribbons, silks and velvets. The silk worm, in all its varieties from the copious transpiration of the watery part of the leaf through the pores of its body, requires a dry and equable atmosphere to carry off the insensible perspiration, and particularly when such a number of them are feeding together. The climate of the Deccan is, I imagine, one of the most natural for the worm of any in the world on account of its temperature, dryness and equability. The Chinamen say it is superior to their own, for the common country worm, gives here a fibre stronger than it would in China.

I feel anxious in risking all my little means on a concern which to be conducted with proper vigour, requires a far greater extent of capital than I could command. The soil too is not so well adapted to the cultivation of the mulberry as many others in the neighbourhood, but to which I cannot extend the sphere of my speculation. It is well worthy, however, of the consideration of Government how far I ought to go on, and in what way I could most effectually attain the objects I have in view, namely the most

away and India was not his home and that on leaving his house which is about 200 miles from Canton two or three of the Cocoons of the large had been in his box, among his clothes and owing to the cold weather they did not come out till on the road to Nuggur when he threw them away excepting the solitary one which came out after his arrival.

efficient mode of introducing into the Deccan a superior silk on the most economical plan—as the Government is exceedingly desirous to improve the condition of the country and to prevent its becoming gradually more and more impoverished the success of my undertaking will probably receive some consideration for the extensive introduction of silk may prove one of the greatest blessings to the poor natives of the Deccan as well as add largely to the Revenue. I would also hope that many of them may be employed as Throwsters of silk, and that in this state the silk may pass into England without any increased rate of duty : every encouragement should be given, in every way, in raising a commodity for which their own climate is so peculiarly fitted.

I have the honor to be &c.

(Signed) A. GRAHAM,

AHMEDNUGGUR, 31*st Dec.* 1831. *Civil Surgeon.*

P. S.—Since writing the above, His Highness the Rajah of Sattara has visited the manufactory in which he seemed very much interested, and has requested me to give him a full account, as far as I can, in Maharatta of the manner of cultivating silk, as he intends commencing among his subjects : after laying out plantations in the way I have done he will send his people to learn the mode of feeding and reeling under the Chinamen. The Dewan of the Rajah of Aukulkote has also promised to commence and to send people to learn under the Chinamen. It is very likely to succeed at Aukulkote as Captain Jameson is very anxious on the subject and they already have a number of large trees, so that they only require to send people to be taught: cuttings of the large are to be sent to me and in exchange I am to send cuttings of the small for their light soils—notices are to be given to the different villages within one day's march of Nuggur, to the Patels and gardeners that mulberry leaves are to be purchased at the Furrah Baugh at 35 Nuggur seers for a rupee, which will no doubt cause the natives to rear the tree as they will find it more profitable to raise them than any thing else, and by planting it along their water courses and as hedges round their gardens, at the same time, it will not interfere with their raising other products. Since writing the above we have

had an opportunity of ascertaining the quantity of pure spun silk: from one of the China tatties the dried cocoon weighed 35 rupees, and upwards of 5 rupees weight of silk was obtained, giving a proportion of 1-7th and much larger than mentioned in the report. The head Chinaman produces a greater proportion of five spun silk from the dried cocoon than any other person.

(Signed) A. GRAHAM,

16*th January*, 1832. *Civil Surgeon.*

MANSFIELD FORBES, ESQUIRE.

MY DEAR SIR,—I have the pleasure to return you the accompanying sample of Ahmednuggur Silk after having been carefully examined at your request by myself and many experienced silk dealers and brokers, we are of opinion that this production is equal to the best Nankeen T. Suttee when in single thread; fairly valued at 11. 2. to 12 Rupees per Pucca seer at this moment, and suitable for English Market if largely imported, because the consumption at Ahmedabad is always very limited for silk of this description, and that only in raw material as this sample has not only been bleached but twisted into double thread ready made either for the purpose of weaving cloth or otherwise.

I remain my dear sir, &c.,

(Signed) HORMUSJEE DORABJEE.

BOMBAY, 12*th December* 1831.

The silk above reported on would probably be considered as thrown silk in the English market—and as such would pay an increased rate of duty—raw silk of single thread is what Hormusjee alludes to—and is a description better known in this market.

LETTER *from* MR. SPEED, *in Trans. of the Ag. and Hort. Soc. of India; pages* 5, 6 *and* 7 *and* 13 *to* 30 *of Vol.* III.

I have been making some enquiries since my residence in Italy, into the process of the Silk Manufacture, or rather the method by which the Italians treat their Silk-worms, and afterwards spin their produce, as I was always of opinion, that the difference in the qua-

lity of the Silk was more owing to the method of killing the worm, than to any great difference in the Raw cocoon, or natural Silk produced by the worms of India and Italy. The cocoon here is much larger than yours, and I have enquired if there is any thing particular in the way of treating and breeding the worm. There are many works published on the management of Silk-worms, and not being able to read Italian I have been obliged to resort to an interpreter. The Italians select healthy subjects to carry on the race. In this they follow nature and act like sensible breeders of cattle and what is known to have effect with ourselves. The breeders know the male and female moth, and also the cocoon which contains each, and they are careful to select the finest. It is probable the Bengalee knows the same and if he did not I am of opinion it would be difficult through European Agency to instruct him, for you would first have to teach the Europeans, and having done so to teach the Natives through them. The Natives *here* are particular in planting the *Male* mulberry tree by slips to feed their silk worms, and the mulberry tree is not to appearance like ours in Bengal, for it is a tree, not a shrub; but it may be worth the attention of Government to ascertain if the mulberry of Italy may not be introduced into India. It can be easily done through the aid of Malta steam communication, and the eggs of the silk worm may be introduced by the same conveyance. It is easy also to cross the breed of silk worms of this country with those of Bengal or even China. You have only to unite a male moth of one with a female of the other, by the aid of the hand. It is so done here, and why should it not be done in India. The perfection of silk is owing to the following.

1st. The good food of the mulberry tree. Any thing in the season which affects the growth of the mulberry leaf, is found to have a prejudicial effect on the silk or the worms that feed on it.

2nd. The Selection of the cocoons from which the breed is carried on, is found to effect the produce, weakly cocoons produce weakly moths and a weakly race and the contrary.

3rd. The weather is found to affect the progress to perfection, and the comfort of the worms &c., &c., is much studied;

and they are not exposed to the extremes of cold or heat. Thunder is prejudicial, and even the *evil eye of a stranger.*

4th. I cannot get at the particulars which regulate the destruction of the worm, and the winding of the cocoon. In the north of Italy, I was told that ovens are regulated by thermometers, to prevent their being heated to a greater degree than absolutely required to kill the worm here. I was told they wind the silk before the worm has time to cut its way through, and with water heated to no greater degree than requisite—on this depends the softness of the silk. Experiment alone can determine this point, what heat is required for the purpose of destroying the worm and whether this cannot be effected by steam, the gas of coal &c., &c., &c. They are not so advanced in Italy as in India in useful chemical experiments, the writers on silk rather describe what the experience of the rearers of the worms have taught them, than what improved science has suggested.

The culture, and expense incurred in the production of silk, being, according to the present system of India, conducted and divided between three distinct parties unconnected with each other, viz., the cultivator of the mulberry plant,—the farmer of cocoons, or rearer of worms,—and the reeler of silk,—must obviously restrain improvement, for though the reeler may, for superior cocoons, give encouraging prices, yet having no control over the selections set apart for eggs, or in the management of the worms, (entirely in the hands of the farmer, who again is rarely the cultivator of mulberry,) it is impossible to surmount the various absurd and superstitious practices and other causes now existing among the natives which tend so materially to check improvements,—Whereas, by condensing the whole into one establishment, every difficulty is at once overcome and it is scarcely necessary to say that as the cultivator of mulberry as well as the farmer of cocoons, must necessarily derive their respective profits, the reeler, who combines both, with his own occupation, cannot but be proportionably benefited ; that is, will not only send into the market a more perfect article, but he will obtain that article at a far cheaper rate than it is now produced.

Impressed with this idea, I formed a *small* experimental establishment, first drawing up for my guidance a sketch of estimate made from Memoranda during many years enquiry, the same as was produced by Mr. Joshua Saunders, in his evidence before the Select Committee of the House of Lords on East India affairs, having been kindly forwarded to him with musters of my trial by Mr. W. Prinsep, and the results of the experiment it will be now my endeavour to make known, dividing for greater perspicuity the information into the following heads:—Stock on first Establishment, and Annual Outlays, by 1st, Cultivators of Mulberry; 2nd, Farmers of Cocoons, or Rearers of Worms; and 3rd, Reelers of silk.

The Stock on first Establishment. 1st, Rearing Houses.—The best size is about 24 feet long, 15 feet broad, and 9 feet high including a raised floor of 3 feet,—the walls to be of earth about a cubit thick, and roof of thick compact thatch, the ridge being 14½ feet from the ground, or 8¼ perpendicular feet higher than the upper part of the wall,—with door-ways to the southward (most preferable) or eastward, and two small windows at nearly the top of the walls on the same sides. Such a house is equal to 200 kouhuns or 2,56,000 worms; that is, 5 ghurrahs or mauchans, each having 16 dalas or shelves of 5½×4½ feet, with a raised rim of 2 or 3 inches, well leaped or plastered with cow or buffaloe's dung; the last being the most esteemed by the Natives, with good appearance of reason, as the odour is more congenial to the worms,—and each of these shelves is sufficient space for 2½ kouhuns or, 3,200 worms, ×16=51,200×5=2,56,000.

The ghurrahs are supported by 4 corner bamboos resting on soraees, or small earthen saucers, to contain water, for the purpose of obstructing the passage of ants and other insects.

To each house there should be 10 chundrukees, pheengs, or spinning mats of 3½×4 feet, with the raised work of 3 inches.

The remainder of the fittings up, are a close bamboo cheek*

* Curtain.

for the door, another for such window, a few baskets of large size for the carriage of leaf; a knife or bytunee, for cutting the same during the early stages of the worm; 3 or 4 *gunnies** for purdahs, or curtains and spreading on the floor, with a small number of earthen pots, or kulsies, for sundry purposes. The whole costing from 50 to 65 Rupees per house, according to the locality and the facility of procuring labour and cheap material. Extra Expense. To every 12 houses there should be an extra building of thatch and mat, 20 feet long 12 feet broad and 8 feet high, with mud floor, serving to put away any material not in use, but more especially to afford protection to the chundrukees or spinning mats, during the night in spinning time; the worm being inclined to relax its operations during darkness and the changed air of the night, to consequent deterioration of the cocoons; while by the influence of light, and protection from night air, the animal continues unremittingly its labour, and hence an improved cocoon. The cost of the Building may be from 4 Rupees 8 Annas, to 6 Rupees 8 or 6 to 9 Annas per rearing house—hence rearing houses from Sicca Rupees 50 to 66.

2nd. Reeling houses or rather sheds—should be 18 feet broad, with sides of 7 feet high,—the length depending altogether upon the number of reels, each pair requiring 10¼ feet, including the spaces allowed for passing; and the perpendicular of the ridge 15 feet, if a tiled or thatched roof, unquestioaably the best, from the vent thereby given for the abstraction of smoke, and which by a flat roof is condensed to the injury of the colour of silk,—open, as the word shed implies on all sides, but with a few moveable *Jhamps* to be placed as weather demands, for instance, rain or high wind.

The expense including roofing, flooring, fireplaces, chimnies, with fittings up, of every kind, even to relieving reels, cloths, &c. &c. from 45 to 64 rupees, according to the means of procuring labour and material, per pair of reels or single chimney.

Extra expense for every 100 reels. A thatch or mat godown,†

* Pieces of coarse canvass of about—cubits long and broad.
† Portable mat walls.

the flooring being Kutcha Pukka,* 40 feet long, 22 feet broad, and wall of 11 feet high, for the purpose of keeping cocoons, &c. &c. (not necessary on an Indigo or other establishment, having always some building, such as a drying house, which will answer the purpose, without detriment to its own specific use) of which the cost may be from 150 to 200 rupees. And to some proportion and even, 60 feet circumference, with 7½ feet greatest height from 90 to 120 rupees.

Hence reeling accommodation per rearing house.

Sicca Rupees... ... ... 17 to 25

Or an actual block per 10 pair of reels of.... 970 to 1,300

Annual outlays by

1st. Cultivators of Mulberry—Ten beegahs of 1,600 square yards, or something better than 3¼ acres of ground, is required for a rearing house of the above dimensions, or the support of 200 kouhuns 2,56,000 worms throughout the year,—that is 10 beegahs will furnish sufficient mulberry leaf for such quantity of worms, each bund,—of which there may be considered 6 in each year; though the actual cuttings of leaf do not exceed 5 in the year. The bunds of Assar and Srabon, (or during the latter part of June, July, and to the middle of August) when the produce of mulberry leaf is greatest, and the worm is of shortest life, (scarcely exceeding 30 days) running into each other form in a manner only one. The technical word "Bund" being equivalent to "the life of the worm." The expense will vary according to rent of land; all *Tooth*† grounds being EXTRA assessed by the Zemindar or landholder, say from 2 Rupees 8 Annas to 4 Rupees per beegah, which in many instances is 6, 8, or 10 times the usual long established rate; that is, a ryot, holding lands from his ancestors for which 5 to 7 annas per beegah have been paid from time immemorial throwing them into mulberry is immediately assessed by his Zemindar from 2 Rupees 8 Annas to 4 Rupees; and sometimes 5, 6, and even 7 Rupees, per beegah (according as he may be a *gureeb* or gostak‡) above the

* Kutcha either of mat or earth—Pukka, masonry;—hence Kutcha Pukka a mixture of both.

† Mulberry.

‡ *Gureeb*, a soft easy person. Gostak, an insolent person, one knowing his own rights and determinedly resisting imposition.

rate he has hitherto paid for such lands.—In spite however of this most unjust, harsh and impolitic measure, this description of cultivation is extending in every district it is pursued; and hence how handsome must be the returns (Query. Might not the interference of a Government be judiciously exercised as ensuring not only relief to a Peasantry, of whom the well being must be one of its chiefest props, but the advancement of a most important branch of trade of this country?) But to a possessor of land, that is, a proprietor by whatever right or lessee on whom rent cannot be increased, the usual rate will be 7 to 16 Annas per beegah.—The best soil, is an even admixture of sand and clay, should be above 5, but under 25 years of settled formation and of a height above the customary reach of annual inundation. When low sites are occupied, one field is raised, by the cutting away from the surface of another, and which renders the grounds, so reduced, generally better adapted for *paddy*,* the trenches round each field, supply no more earth than is sufficient for the necessary embankments, and for the first year the expense is of course the heaviest, subsequent years not being perhaps 50 per cent of such amount,—it may be estimated say for

	First years.						Subsequent years.					
To	Renters.			Possessors.			Renters.			Possessors		
Rent,	3	8	0	0	14	0	3	8	0	0	14	0
First koddalling or hoeing in preparation of land,	0	8	0	0	8	0	0	0	0	0	0	0
Ploughing,	0	8	0	0	8	0	0	0	0	0	0	0
Slips for planting,	1	8	0	1	8	0	0	0	0	0	0	0
Collecting grass and rubbish when planting,	2	8	0	2	8	0	0	0	0	0	0	0
Weeding and koddalling, after cuttings when necessary,	2	8	0	2	8	0	2	8	0	2	8	0
Embanking subsequent years being simply repairs	3	0	0	3	0	0	0	8	0	0	8	0
Shewing Totals in each respect of,.....	14	0	0	11	6	0	6	8	0	3	14	0

In dry situations these rates will be increased by the necessity of irrigation some 4 or 12 Annas per beegah, according to the command of water, each time that it may be considered necessary;—

* Coarse or Common Rice.

And produce,—if planted the latter end of October, or during November, (by far the best month) the leaf will be ready for the worm in March, though it may be planted any time during the year, except the very cold weather and rains; the first returns being always at a later or earlier period in the 4 months from planting. Each beegah during the year yields about 50 bundles or 5 buttings of 10 bundles each; often 12 and 15; but falling to 5, new grounds are substituted. The size of a bundle is as much as a man can carry weighing gross (wood and leaf) about 38 *Seers of* 80 *Sicca Weight*,*—from October to April the leaf is in the highest perfection; but from May to July it is immature, soft, and indifferent,—after which, in consequence of a suspension of worms, the plant is cut short, the grounds are koddallied (hoed) and cleaned, and the roots moulded till again required for the *Kartik* † bund, by some commenced in Sept. but to greater advantage if deferred till October, therefore say,—Abstract produce of 10 beegahs equal to 1 rearing house, $1 \times 5 \times 10 \times 10$ bundles = 500 of mulberry‡ leaf, or,

For the	Nov.	Bund	110	Bundles.	At an Expense to Renters.				Possessors.	
„	Feb.	„	90	„						
„	March	„	80	„		Sicca Rs.			Sicca Rs.	
„	April	„	60	„	The 1st year,	140	0	0	113	12 0
„	May or June	„	90	„	And subsequent years.	65	0	0	38	12 0
„	June or July	„	70	„						
Total Bundles, ...			500	„						

2nd. Farmers of Cocoons or rearers of Worms,—of which last there are 4 kinds.

1. The Burra, or large annual Pooloo supposed to be the Italian, and seems to have been introduced into this country about 120 years ago, but in what precise year, or by whom, is not as-

* Seer of 80 Sicca Weight, a fraction better than 2lbs. Avoirdupoise.

† Say the November bund.

‡ Producing black fruit, and of which the leaves are rarely given to the worms, never during the two first stages or kullups. The sar leaf is large, that of the Bhor is small; and both chiefly prevail in the Midnapore and Hooghly districts.

1. The Sar.
2. Bhor.

The kinds in chief use differing little from each other; the leaf of the latter being somewhat jagged towards the stem, while that of the former is plain,—and the leaf of both is rather smaller than of the two preceding.

3. Désee.
4. China.

certained; cocoons in March or April; 1 puhun or 80 yielding about 3½ kouhuns,* or 4,480 cocoons, which is a proportion of 56 to 1,—that is, as allowing, by the Natives, for the chance irregularity of *pairing* and failure or destruction of eggs, during the long keep from March or April to January or February, but 80 males and females carefully selected, that is 40 *true* pairs will produce upwards of 10 kouhuns or 12,800 eggs being a proportion of 160 to 1. In Italy, according to the best accounts the proportion is 192 to 1. The colour of this egg is, first a yellowish white, changing to a slate colour in the course of 36 hours; about the 5th day from the change, the centre of the egg contracts leaving the *circumference* full, as if the worm was actually formed, and in this state it remains for about 10 months. The life of this worm is from 42 to 50 days, and the cocoon lasts from 10 to 15 days.

2. The Dêsee or country Polóo, of a small size,—cocoons 5 times in the year at periods of from 40 to 110 days, thus—

Chrysalis within cocoon.	Propagating in	Keep of Eggs.	Hatching in	Life of Worms.	Cocooning in	Forming Total Periods of
Days.		Days.		Days.		Days.
4 to 5	July,.....	55 to 60	September,.....	40 to 45	November,....	99 to 110
7 „ 8	November,.....	20 „ 25	December,.....	60 „ 65	February,.....	87 „ 98
7 „ 8	February,.....	8 „ 10	February,.....	45 „ 50	April,.....	60 „ 68
6 „ 7	April.....	7 „ 8	April, ..., ...	30 „ 35	May or June,..	43 „ 50
4 „ 5	May or June,..	8 „ 7	May or June...	30 „ 32	July,.....	40 „ 44

according to which also is the quality of the cocoon, the longest period producing the best,—1 puhun or 80, will yield about 6 kouhuns or 7,680, which is a proportion of 96 to 1. From the comparative short time these eggs are kept, there can be little destruction, or failure, as in the former case; but careful attention to the superiority of proper *pairing*, of the cocoons selected for eggs, will no doubt augment proportionate productiveness.

3. Madrassee or China Pooloo, was introduced into this coun-

* 16 Puhuns=1 Kouhun.

try, though by whom not ascertained about the year 1780 or 81, but degenerating by reason of carelessness, and improper management of the worms; a fresh supply of eggs was, two or three years after, obtained by a Mr. Frushard, which again falling off immediately his direct Superintendence was withdrawn; a third supply was brought by the late Colonel Kyd in 1788, from Canton, which, from the vast increase he effected by personal attention for a considerable time, forms the origin of the present stock of this description of worm,—cocoons monthly between November and June, if attention be paid; but more generally from January to May. Rate of breeding much the same as the preceding, than which it is of a somewhat larger size, and is, perhaps, the most profitable sort of worm, being of shorter life, will feed on indifferent leaf; and is of hardier constitution, that is, less liable to be affected by the vicissitudes so injurious to other worms. And, 4, a cross breed between the two last, partaking even to a greater extent of the cheap qualifications of the Madrassee, as respects the cost of production of cocoons, which resembles that of Dósee,—but it is decidedly an inferior worm to either; for the cocoon being of loose texture, though imperceptible in outward appearance, throws off a weak rough silk; and is the medium of vast imposition, under the Dósee semblance at British reeling establishments, supported by a combination of the servants with the farmers of cocoons, and others interested.

It is worth remarking here, that of similar description, that is, as regards the three first, do the worms of Italy appear, for by Dandolo there are

The large worm of which	750	cocoons	weigh	7½	lb	and give	11 oz of silk
small do.	„	3,000	„	7½	„		11 „
common do.	„	1,800	„	7½	„		11 „

And how vast the advantage *of this*, over every other country, China (perhaps?) excepted from the *perpetual* nature as above seen of the worm?

With respect to mulberry leaf, though the average quantity required for each house has already been stated it is necessary to

show the more immediate rate of consumption—and which is, by worms producing cocoons.

Months.	The life of worm being		Stage or Kullup.				Total bundles of Mulberry Leaf.
			1st.	2nd.	3rd.	4th.	
	Days.		Bundles.				
In November.....	40 to 50	During the	1	6	21	53	81
February.	60 to 65	..	1	8	24	61	94
March....	42 to 50	..	1	8	23	61	93
April.....	45 to 50	..	¾	6	22	56	85
May or June....	30 to 35	..	½	4½	18	50	73
June or July....	30 to 32	..	½	4½	18	50	73
							6) 499

or an average of bundles per bund 83 per rearing house; which with advertence to the duration of life of the worm, shews that the consumption of the leaf is during the first two bunds in comparative minimum rate, the period being in fact the proper season for mulberry the 3d and 4th bunds in about medium and the last 2 bunds in maximum quantity, the leaf during the rainy months being soft, watery and immature, as stated above, consequently great wastage by the worms. It is also to be remembered here, that the March worm, supposed to be Italian, is the most delicate; it ought not therefore to be crowded on the *dalas*,* and should at all times be supplied with plenty of leaf. Of the mulberry about 3-5th is actual leaf and 2-5th wood and waste. During the 1st stage, or kullup, the leaf must be very finely cut up; for the 2d, quartered; and for the 3d or 4th it is given whole on the stick, as cut from the field most carefully cleaning out every morning of the last two stages or kullups, the worms being easily removed for such purpose after they have ascended on to the fresh supplies. The supplies of food are given twice a day during the 1st and 2nd, and every 6 or

* Shelves on which the worms are placed.

8 hours of the last 2 stages or kullups, and even oftener if the worms are observed to eat with avidity, which is generally the case for two or three days in each of the latter stages or kullups; (these observations apply generally, excepting the immediate times of change, when the worms do not feed.) As soon as the worms are ready to spin, they turn from a greenish cream, to a mellow light orange colour, not unlike the pulp of a ripe papaya imagined with a bloom on it, with a transparent streak down the back, passing, as is observed, the emission, *from tail* to head, which forms the silk; they are then put on to the *chundrekees** placed in the open air, facing the sun when not too powerful, or turning aside a little in such case, but under no shade; and all night under cover (as previously adverted to) with a lamp burning till past midnight, as well as just before day break. The worms work with activity, for 36, and gradually relaxing continue their operations till 56 hours, when the spinning ceases, and about 4 or 5 days afterwards the cocoons are ready for reeling except during the Bursath† or last 2 bunds, when they will be ready the 3d day; and not keeping sound for many days should be run off as quickly as possible, while at other periods killing the grub, either by exposure to the sun for about 4 or 5 hours, during the cold weather, or heating in an oven at a moderate temperature for about 3 hours in the hot weather—preserves the perfection of the cocoons say—

The Burra Pooloo, or presumed Italian worm				for	8 or 9	months.
„ Désee	„	„	Country worm	„	2 „ 3	„
„ Madrassee	„	„	China worm	„	„ 1	„

The expense, independent of the cost of mulberry leaf, already considered :

Eggs. Once in each year, that is, of the Désee worm, —being after 1st provision supplied by bund to bund successively free of cost at 4 Rupees per house; and of the Burra Pooloo—also being *once* provided—may, with little attention always be kept *sans* charge at 5 Rupees per house; equal altogether to, ... Sa. Rs. 9 0 0

* Spinning Mats. † Rainy.

*Busnee Wallas**—2 the whole year @ 4 Rs. each per Month, ...	Sicca Rs.	96	0	0
Assistant Do.—1 do. @ 3 do.	,,	36	0	0
Extra Coolies,—4 for 2 Months: that is, an even average of 10 days in each bund, being a part of the 3d and the whole of the 4th stages of the worm, @ 3 Rs. each per month	,,	24	0	0
Oil—For 263 days @ an even average of 3 chittaks per day, say 50 seers, @ 5 seers per Rupee	,,	10	0	0
Chowkedaree,—1 being sufficient for 12 houses @ 3 Rs. per month, is for the year 36 Rs. of which the twelfth	,,	3	0	0
Gives a total amount, Sicca Rs.		178	0	0
And though subsequent years should be less, the price of eggs, to cover wear and tear of building, say an actual expenditure per house and annum, of	Sicca Rs.	185	0	0

The produce as will be seen by what has been already stated is 256,000 cocoons; but this being a computation, with express reference to the Désee or country worm, allowances ought to be made for the difference, in size, of each kind. This is best explained by stating that on the *fifth day of the cocoon* the number to a seer of 80 Sicca weight is,

of Désee	2,080	or	2,56,000	a total weight	3	Maunds	3	Seers	per house.
do. Madrassie	1,760	do	2,17,000	do	3	do	3	do	do
do. Burra	1,280	do	1,57,000	do	3	do	3	do	do

exclusive of the extra returns arising out of the short life of the Madrassee or monthly worm, during at least 4 bunds, and fully equal to 50 per cent; though such differences, with the under calculation of 2,56,000 to each house (the actual number being frequently 20 per cent more favorable) as well the moderate average taken of the mulberry leaf production, are not taken into account,

* Persons whose especial occupation is to attend the Silkworm.

with the view of making allowances for every possible chance of poor harvests or failures in crops of cocoons,—therefore the Produce of cocoons per house per Annum, on average may be fairly estimated, of 80 Sicca Weight at 18 Maunds 18 seers and expense, exclusive of Mulberry, that is, in rearing worms per house per Annum Sicca Rs. 10 per Maund, or ... ... Sicca Rs. 185

3rd. Reelers of Silk.—The quantity of cocoons throughout the year should be calculated according to the different descriptions produced at the different periods of the year, and on moderate assumption the probable proportions per house will be.

Months.	Description.					Total cocoons according to respective periods.		At the rate of koulans of cocoons per day.		Reels.
	Proportion.	Désee. Number.	Proportion	Madrassee. Number.	Burra. Number.					
November, ...		2,56,000				2,56,000		4½		44½
February, ...	⅛	96,000	⅛	1,36,250		2,32,250		6		30½
March.					1,57,000	1,57,000		3½		35
April, ...	⅛	96,000	⅛	1,36,250		2,32,250		7		26
May, or										
June, ...	⅛	96,000	⅛	1,36,250		2,32,250	And reeling.	9	Gives	20
June, ...										
or July, ...	⅛	96,000	⅛	1,36,250		2,32,250		10		18
									of which	174

The expense, *Kutanees* and *Paydars* 1 each to each reel at 8 Rupees per month, ... Sicca Rs.	46	6	8
Coolies,—supplying water, wood, &c. &c. @ 1 per pair of reels at 2 Rs. 8 As. each per month, ...	7	4	0
Wood,—@ 1½ maunds per reel, (though this rate may be reduced to one-third or one-fourth of the quantity by a variety of ways) equal 261 maunds to include splitting,—17 Rs. per 100 maunds, ...	44	6	0
Establishment, with rent of building to cover interest &c. &c., ...	8	3	4
Amount,...Sicca Rs...	106	4	0

And Produce.	Months.	Reels.	Cocoons.	RATES. Kouhuns per Reel per day.	RATES. Size of thread.	BY CUSTOMARY LIMIT. Tolas or Sicca wt. kouhuns of cocoons.	BY CUSTOMARY LIMIT. Quantity of silk.	OF PRIVATE ACCOMPLISHMENT. Tolas or Sicca wt. kouhuns of cocoons.	OF PRIVATE ACCOMPLISHMENT. Quantity of silk.		Highest private Reelings.
						A.		B.			C.
				Kouhuns	Cocoons.	T. A.	S. C.	T. A.	S. C.		T. A
	Nov.....	44½	2,56,000	4½	7 to 8	4— 7	11— 1½	5— 7½	13—11	Private Reelings have been as high as	5—14
	Feb.....	30½	2,32,250	6	10—12	3— 5½	7— 9½	4— 1½	9— 4		5— 6
	March ...	35	1,57,000	8½	4—5	5—12	8—13	6—14	10— 8½		7— 4
	April. ...	26	2,32,250	7	12—14	2—14	6— 8½	3— 7	7—13		4— 6
	May or June.	20	2,32,250	9	18—20	2— 8½	5— 0½	2—12	6— 4		0— 0
	June or July...	18	2,32,250	10	20—22	2— 0	4— 8½	2— 6	5— 6		0— 0
						M 1 3 9½	or M 1 12	14½	of 80 sicca	Wt.	equal are.

by private accomplishment per column B. of nearly 6 Factory seers per beegah of ground per annum. These results however, as will be perceived by the proportionate increase shewn to every bund in columns of produce marked above A, B, and C, that is, of the averages of "customary limit," "private accomplishment," and "highest private reelings,"—susceptible of very great amelioration; in chief manner, 1st. By improving cocoons, effected by carefully selecting the cocoons of best quality for propagating; and nice attention to cleanliness, and good feeding; and 2ndly,—By encouraging the dexterity of the reelers; who, it must be obvious to all conversant in this respect, have much in their power, and may return in fact as little as they please even from the best cocoons; and from such as are of indifferent quality, may effect a far more favourable produce than in usual course to be calculated. Indeed close attention in these respects is the only *effectual* way of lightening the burden of reeling charges, as will appear manifest thus: Supposing 8 skeins, weighing 4 chittaks of silk, to be the customary rate of reeling, it is certain that if 12 skeins, weighing 6 chittaks of precisely equal quality as the 4 chittaks, be instead *thrown off by* the

same party from the *same reels*, and *within the same space of time*, as is frequently the case, a saving of 50 per cent of the whole extent of charge is effected: or 10 skeins of 5 chittaks, 25 per cent and with a superior cocoon with equal reeling, it is of course to be presumed, that *a less number will give equal weight* of silk, and this power seems to be no less understood by the reelers of Italy, than in India, for DANDOLO remarks, "It is a well known fact, that of two spinners, spinning each 7½ lbs. of cocoons of the same quality one will extract constantly 8oz. of silk, whilst the other will only draw 6½oz and perhaps still less. There are even spinners so ignorant (or rascally ?) that in giving constant jerks and strokes of the handle they destroy several layers of silk enveloping the cocoon; others extract less silk, because the water is too hot in which they spin."—Further, abstract contrivances, which every one using his own capital will endeavour to benefit by, may economize fuel, for instance to one third, or one fourth, of the quantity expended or, some 60 to 75 per cent.

SUMMARY OF COST OF MULBERRY CULTVATION TO

	RENTERS OF LAND.	POSSESSORS OF LAND.	MEAN.	
First years.	Sa Rs. 140	Sa Rs. 113 12 0	Sa Rs. 126 14 0	
Subsequent years,	—— ,, 65	—— ,, 38 12 0	—— ,, 5 14 0	Difference Sa Rs. 75.

Add,—for the purpose of equalising the extra outlay of the 1st year, alike benefiting, (in fact forming a part of) future years' expense; and supposing 8 years' duration of the plant, though if taken care of it will last 30 or 40 years,—a due propor-

tion of the "difference" shewn in extention ... ... Sa. Rs.	9	6	0
Also Chokedaree omitted above ... ... „	3	12	0
„	65	0	0
Cocoons ... ... „	185	0	0
Reeling, ... „	106	4	0
Sicca Rupees.	356	4	0

	And of Produce.		
	Factory Weight.	Of 80 Sa. Weight.	
Less Shakespearian.			
Ghyees. 10 8 6 9 1	M. 1 8 0	M. 1 4 0	As per customary limit of reeling that ought not by above date to cost above 7 Rupees 6 annas per seer.
Ditto--ditto. 8 9 5 7 3	„ 1 18 0	„ 1 1 3	Or per private accomplishment, 6 Rupees 1 Anna per seer.

and even at a much less rate may it be effected than is here stated,—as shewn by the concluding remark under "Reeling head," as well as by the columns A. B. C. in the Table produce.

It may be further observed, that the capital required for embarking in an undertaking of this nature, is comparatively very trifling. Suppose, for instance, an establishment of 10 Reels, and keeping them at work for about 263 days or something better than 2-3ds of the year, that is, allowing for the suspended propagation of the worm, and impossibility of keeping cocoons during the rains.

Actual block, exclusive of mulberry cultivation: that is, for building alone, Sa. Rs. 970 to 1300, say a mean of, ... Sa. Rs. 1,135 0 0

And advance of annual outlay for 263 days ×10 Reels, ...					2,630	
—of which 174 as above, is about the 15th part—therefore the proportion will be 15 times the amount of the following cultivation of mulberry ½ of summary, ...	32	8×15=	487	8	0	
Do. cocoons ¼ of ditto,..	46	4×15=	693	12	0	
Reeling, something more than ⅓ of ditto.	39	12×15=	596	4	0	
					1,777	8 0
			Sicca Rupees,		2,912	8 0
When there would be a return of maunds 8 4 Factory weight of silk which @ Sicca Rupees 9 per seer, is			Sicca Rupees,		2,916	0 0

or the original capital back, and henceforth of course providing its own outlay—the state of the undertaking, having the future prospect for remaining portion of the year.

Dr.—Mulberry cultivation remaining	½ to be paid	487	8	0	
Cocoon Do.	¼ „	2,081	4		
Less proportion for Novr. bund unrealised		693	12	1,387	8 0
Reeling, remaining proportion, ...		997	0		
Less as preceding, ...		412	4	584	12 0
					2,459 12 0
Cr.—Block in building, .. — — —		Sicca Rs.	1,135	0	0
Do. Mulberry cultivation, 152 beegahs,...		—	487	8	0
Expectancy of silk during the remainder of the year, M 8 @ 9 Rs. per seer,—			2,880	0	0
					4,502 8 0

This is of the 1st year, exclusive of the November, or most abundant bund, and being also inclusive of block, the 2d and subsequent years would of course be yet more favorable—and in estimate of 2d and subsequent years the expense and returns, say—

Dr.—Mulberry cultivation.	Sicca Rs...	975	0	0
Cocoon cultivation...		2,775	0	0
Reeling		1,593	12	0
				5,343 12 0

Cr.—Maunds 21 seers 28 Factory weight of silk 868 seers, @ 9 Rs. per seer. ... ... Sicca Rs...	7.812	0	0
Or a profit of about 47 per cent on current transactions of the year with a free block.	2,468	4	0

The same being an average of seasons and bunds, exclusive of the advantages resulting from improved cocoons, superior dexterity of reeling and reduction of expense. Mulberry and cocoon items being also, for the sake of even numbers and calculations, computed in excess of actual charge, and proceeds of *Jooth* chusse or waste (about 8 maunds) thrown out to cover interest and other charges on current outlay.

It is also to be considered that the buildings were fully covered the 1st year, and which with 152 beegahs of Mulberry is standing block and upon the same rate of expenditure, with fairest probability of same expectations, may the undertaking be embraced in, to any extent.

Perhaps the more correct way of shewing this statement would be thus

Deduct the difference between the 1st portion of outlay Sicca Rs. 2,912—8, and its return 2,916 equal.... ... ... Sicca Rs....	3	8	0
From the amount of 2d portion of outlay. ...	2,459	12	0
	2,456	12	0
When again the return will be....	2,880	0	0
Equal to a profit, over and above the clearance of block, of.	423	12	0

Being in the aggregate better than 50 per cent the 1st year, and as the actual advances for the 2d and subsequent years will not from the perpetuality of the returns, say every 4 months, exceed 2,000 Rupees,—the profit will be equal to the enormous rate of 250 per cent.

(Signed) D. W. H. Speed.

Calcutta,
30*th April*, 1832.

P. 59 and p. 170 to 197 of Vol. VI. of Tr. of Ag. Hort. Soc. of India.

" Some Silkworm's eggs, brought from Bengal by Monsr. Gaudichaud in the " Bonite" on her return from circumnavigating the world, were examined a few days ago by order of the minister of the marine, by Professer Andonin, in the presence of Monsr. Camille Beauvais and several persons interested in the result, and were found to be in a perfect state of preservation. It has hitherto been deemed extremely difficult, if not impossible, to bring silkworm's eggs across the line, as they are generally hatched when brought into the temperature of 20° of Reaumur, or 77° of Fahrenheit. The eggs in question were preserved, some in alternate rolls of tinfoil and thick paper, others in a bottle. A very few eggs had been hatched, but they bore no proportion to the total number."

The necessary preparation of the Land for the cultivation of the Standard Mulberry Tree.

If the ground be not level, it should be made so, to prevent an unequal distribution of water during the monsoon.

All trees or shrubs on the ground, should be cut down, or else planting within their shades must be avoided, as they not only impede the growth of the mulberry tree but also greatly diminish the quantity of the leaves, and materially injure their quality.

In order to check the growth of grass, which abstracts no small portion of the nourishment intended for the plant, the land should be well ploughed and harrowed twice before planting. The month of April is the best time to do this.

The holes for receiving the trees should be made some time previously to their being planted, for there is a very great advantage in having the ground well softened. These holes should not be less than two and a half feet square. The depth need not exceed 2 to 2½ feet, but less will do if the soil be not deep, as the root of the mulberry grows horizontally and not downwards.

The advantages resulting from having the holes made sufficiently broad, are indeed very considerable, for the tender roots when not meeting with the resistance of a close, hard earth, quickly extend and multiply, and thus a fine healthy tree is speedily produced, whereas when the earth around is hard, vegetation is greatly retarded, for the roots, by the resistance opposed to their extension, become cramped and weakened, for want of sufficient earth to nourish them.

When a plant is observed to remain weak, and its growth appears injured, it is advisable to root it up, and substitute another as great success cannot be expected in such cases; but if the plant has not been a long time in the ground, cutting down near the roots may be tried, taking care, however, to dig and water the ground a few days previous to this operation.

Manuring.

The manure is an object of great importance, and should be taken into immediate consideration in the Deccan, as that which is usually obtained in the villages and city, is not good. It is therefore advisable to prepare the manure on the premises, in the following manner:—

Dig a hole in the ground, and fill it with leaves, bones, the cuttings of leather, old chunam, and animal dung, and fill this hole with water two or three times, unless it is made during the monsoon, which is the best season for favoring decomposition. The mass should be occasionally stirred with a stick.

The leaves and litter taken from the Worms is an excellent manure.

Hedges.

Should the land be without good hedges, they must be made, otherwise the cattle will destroy the young plants, as it is the custom of this country to suffer them to wander at large without any person in charge of them. In the hot season especially there is always a great number of these wandering cattle, which travel many miles from the city and villages, and commit devastation during the night.

The Standard Mulberry Tree.

This very valuable plant, if well cultivated, thrives amazingly in the Deccan, as may be seen by the several plantations I have made at Poona, and from my statement in the Appendix.

It requires indeed, that care be bestowed upon it principally in the proper preparation of nurseries, and close attention to it at the very commencement of its growth.

For our object is not only to produce a large tree, but to make it a rich one, and by rearing it are the best system to obtain a supply of substantial leaves.

There are several species of the mulberry tree, the leaves of which are more or less adopted for feeding the Silk Worm. Some of these kinds are incapable of attaining the size and height of a large tree, others become too bushy, &c.

I shall notice some of those to which the preference is due.

The St. Helena species bears a fine united leaf, and in great quantity, of which the Worms are very fond. It is of much quicker growth than any other species, and agrees with every soil, though the black seems to be the one best adapted for it. It requires less water and digging than any other, but a peculiar management is required for its cultivation; for if improperly reared, the plant becomes bushy, throwing out numerous twigs and small leaves, and also bearing abundantly of fruit, which is small, black, and very sweet. The plant is naturally bushy, and requires (besides being pruned regularly like the other species) an additional pruning once or twice a year, but only to the extent of a few branches and twigs, and that after the third year of the plantation.

The white Mulberry has a rather thick, but an excellent light and glossy green leaf, which can be kept for two days without becoming dry or shrivelled. This species agrees best with either a red or whitish soil. It requires more irrigation and digging of the soil than the St. Helena, but still does not attain quick growth. It bears a white small fruit.

The red has a large thick and glossy leaf, and a black long fruit resembling a cock's comb. It grows tolerably well in any soil, but requires much water and digging. It does not require so much pruning and thinning as the others. Its leaf is very good for the worms, but is not so fine as the others, and contains more moisture.

The Kotroor Dopia Folia.—This species is a transmigration from the St. Helena.* I have two trees of this interesting species in my establishment here. One of which changed the first year after planting, and the other in the second year. It bears a long fruit, and has a very good leaf resembling the red, but about half its size, and is still more glossy and thick, with a finer leaf. It grows tolerably well.

The common country "Shah" Toot has a long white fruit. With plenty of water and digging, it grows tolerably. This species becomes a very large tree in any soil, and supplies a very great quantity of leaves. It is the only species that although unpruned and unattended to, grows large and continues to furnish leaves in abundance, but of course requires a longer time. Its leaves are larger than those of any other species, and resemble the Fig leaf. They may be given for food the second day after being gathered, but the worms must be very well reared and healthy to be able to eat them, as they are very coarse and hard. This is the principal objection to them. When the tree is old, the leaves become much smaller and better.

Dapooree Dopia Folia.—This thrives better in red and whitish soil, but grows very slowly. I cannot recommend its cultivation, as it is in many respects inconvenient and unprofitable.

There are several other kinds possessing large leaves, but most of them are ill adapted for the worms; some never become large trees; the leaf of others is found to contain a great quantity of moisture; some as soon as they ripen become immediately dry and black; while others again become so as soon as they are gathered.

The mulberry becomes a very large tree and lasts for a great many years. It may be propagated by seed, by slips and also

from layers. The first is the best mode, for then the tree lasts a longer time, becomes larger, and yields more leaves. The length of time (about two years) indeed, which it takes to come to maturity, when planted from seed, has been objected to. But in this, as in all similar cases, we should look to the great returns that will ultimately be obtained as a compensation for the delay.

One great object I have in view is to induce the Natives to look to the future, to create in them an interest in the land, and to show of how much more value ground may become to them by being made a lasting and valuable plantation, descending to their families, than by being merely employed in a succession of crops of comparatively trifling value.

The Mulberry Standard Tree does not require so much water as is generally supposed, but may be successfully planted in the land where there are no wells, and which are merely watered by a puckhal. In this case, the plantation should be made a little before the commencement of the monsoon.

The growth of the tree will not be so rapid from this mode of watering, but the difference will not be very great. I may adduce an instance in the trees that have been planted in the bazar and city of Poonah, and in the lines of the Bombay European regiment.

With regard to the period of watering, the following directions must be attended to :

For the first two months after a mulberry has been transplanted (in a black soil) it will be quite sufficient to water it once in 8 or 10 days. For the other months of its first year, once in 10 or 12 days, afterwards 12 to 14, and so on.

A little practice soon teaches us by the appearance of the leaves when the plant requires irrigation.

The nature of the soil will make some difference.

Watering by the puckhal, should not be sparingly performed, as is usually done, but copiously at every time.

It must here be remarked, that the growth of the tree does not depend entirely on the quantity of water and manure which may be given to it, but also on the care which may be taken in digging the soil and keeping the earth around the plant loose and in good order.

Should the monsoon, even, (as is sometimes the case in the Deccan) disappoint our hopes, the progress of a well cultivated mulberry tree, will not be retarded by this circumstance, nor the supply of leaves be materially diminished.

The Mulberry bears fruit twice a year, in March and November. That of the St. Helena tree I have sold in the bazar at 5 and 6 pice the seer. For that of the red 8 pice can be obtained.

The fruit of the tree may always be turned to some advantage. Good vinegar can be made from it, and sold at a profit; or during the hot weather very refreshing syrups and sherbets may be procured from it.

When the leaves are ripe, the best plan would be to gather them with scissors. To gather them by the hand requires extreme care, so as to avoid injuring the buds and bark. With the scissors the operation can be always safely performed and a little practice soon renders the method easy.

In gathering, three or four leaves should always be left on the top of each branch.

Plants are subject to much injury during the digging of the soil, if this is carelessly done; particular attention, therefore, ought to be paid at these times not to wound or otherwise injure the plant.

I come now to the very interesting subject of pruning.

The treatment of the tree in its progress to maturity is not always the same, but depends much on the growth and condition of each individual plant. If a plant be prosperous from the commencement, it will not give much trouble in pruning. Some of the lowest branches in such cases only require to be cut. Vegetation in general proceeds upwards, but it sometimes happens that the strength of

the tree is diverted to one or two of the lower branches, the upper remaining poor. In those instances, cut the former off close to the bud. Generally speaking, the upper leading branches should not be touched until the tree is one year old, when we begin to form the lateral branches. The first branches are formed by checking the growth in the leading ones, after cutting which the sap is diverted to the lateral branches, giving the tree a round lofty appearance. The side branches however would also grow long and straggling, and are also cut at 18 to 20 inches from the stem, leaving the eyes or buds outside, so that the middle of the tree may remain clear.

The interior of the tree should be cleared of all branches so that the sun and air may freely penetrate. In about 8 months' time, it will be proper to cut the new shoots, and form the *second branches*. These should be left longer than the first; about two and a half feet will be the proper length. After about 8 months, the new shoots are again cut still longer, say about 3 feet, and so are formed the *third* branches. In this manner we proceed, taking care that in cutting the buds are all left outside, and the interior of the tree all cleared. A tree treated in this way soon acquires a strong healthy appearance and produces a quantity of leaves.

From this method of pruning also an additional and great advantage arises; steps are formed in the tree itself, and the labourers are enabled to climb into it for the purpose of picking the leaves, without the necessity of using a ladder.

When a plant is observed to make no rapid progress, and the stem, though long, is deficient in size it will be necessary to cut the stem itself. This should be done at that height from which it is intended the branches should proceed, and we may thus expect new and strong shoots.

There is no fixed height which the stem should be required to reach, before the division of the principal branches; but the most convenient height for their division will be at the distance of four feet from the ground.

The principal object in the treatment of the tree, and which must always be kept in view, is to form a large stem or trunk. We

must bear in mind, that the vegetation of the Mulberry in this climate, is very rapid, and the nature of the tree inclines it to attain a great height in proportion to its thickness; consequently, we must rather endeavour to retard its progress in height, than to allow it to proceed with the usual rapidity. In such a rapid progress the stem acquires little strength, and we are subjected, in order to remedy this, to frequent cuttings of the branches, which entails labor and loss of time.

It is necessary even, to be very cautious, in cutting the mulberry, especially when it is a young plant, as it is liable to be impoverished. Pruning and thinning, are no doubt, essentially necessary operations for improving the leaves, and increasing their quantity, but if these are unskilfully performed, a contrary effect is produced.

Period of gathering the Leaves.

If the tree be of the St. Helena species, this may be done after, but not *before* the fifth year. We may, indeed, when the tree is only four years old, begin to rear the worms on the leaves procured by pruning; but those obtained in the preceding three years being so small in quantity should be sold, unless the plantation is so extensive as to afford them in sufficient quantity to render it worth while to commence rearing. The other species of mulberry require a delay of about two years more, and even then I do not think the same quantity of leaves can be expected as from the St. Helena tree.

No consideration should induce us to attempt the making of silk before the tree has attained a proper age. We only thus incur much inconvenience and loss. Of the truth of this I have had myself unfortunate experience, but my case, (an extraordinary one,) required it. Every plant requires its own time to come to maturity, and I cannot possibly understand why the mulberry should be considered an exception to the rule. On this subject all reasoning about climate is useless. The climate has its limits, and nature every where maintains her own principles, an ignorance, or abuse of which is invariably attended with evil consequences. The

cultivation of silk, like all husbandry, requires steadiness and perseverance in *one* object.

In concluding therefore, this branch of my subject, I shall only add, that in the cultivation of the mulberry tree, it is clearly our interest to devote our whole attention, in the first instance, to the growth of the tree, and until it be fully grown little more should be attempted.

Nursery by Slips.

The ground is to be properly prepared, manured, and watered.

Select the cuttings from a good and thriving tree and while vegetating. Let the slips be neither too large nor too thin. The length of each cutting should be 7 inches. They should be cut at the top and the bottom horizontally, and not obliquely. Cut close to a bud and remove all the buds, with the exception of one above.

If the cuttings are not planted during the monsoon, they must be put in water for one night previous to being planted.

The slip is to be stuck into the ground two-thirds of its length, in a perpendicular, and not on oblique direction. The cuttings must be planted separately, and not two or three together. Their distance from each other must not be less than 1½ feet. They are arranged in a straight line, leaving between the lines another 1½ feet of space for the convenience of weeding. Care must be taken to keep them clear of grass.

If the slips are put down in the hot weather, (which cannot be recommended,) it will be necessary to cover them during the day with a grass chuppar, but at this period their growth will always be slow, even with frequent watering.

At other seasons, provided the above directions are well attended to, a prosperous and quick growth of the plants may confidently be expected.

Of the St. Helena species of Mulberry (except when planted in the hot weather) every one of the cuttings will spread and come forward. Of the other kinds, but few cuttings are generally found to succeed, and they require more frequent irrigation. For the propagation of these, therefore, recourse must be had to seed or grafting, or layers. In bending down to the ground branches for the purpose of layers, care must be taken that they be not broken and the bark all round is to be removed.

Nursery by Seed.

As soon as the fruit is ripe, it is to be collected and placed in water mixed with sand. In this it must be well rubbed by the hands in order to separate the seeds. The ripe and good seeds will soon fall to the bottom of the water. The seeds must be treated thus two or three times till they are freely divided. They are then exposed to dry and preserved in a bottle, if not wanted for immediate use, but the sooner they are used the better.

If the seeds are sown in the hot weather, they should be covered during the day, so as to protect them from the sun, or they may be sown in a shady place in baskets. The night before sowing they should be soaked in water.

The ground having been well ploughed and harrowed, and the earth perfectly pulverized, manure is to be laid on, and the seeds being sown, the earth is to be slightly turned over them. Water should now be poured over the ground from a tin watering pot, or earthen vessel, but this must be done gently, otherwise the earth is liable to be washed away, and the seeds disarranged. In 8 or 10 days the plants generally appear.

In about three months a *second* nursery should be formed, and the first plants transplanted at a distance of 16 inches from each other. After 3 or 4 months, a third nursery should be made, and another transplanting at a distance of 24 inches effected.

The Mulberry from seed, differs in the organization of the root, from that produced by cuttings. The first has only one long root,

which requires to be cut off, very little of it being left the second time after it is transplanted, so that hereafter regular roots may spread around it.

Transplanting.

There are two methods of transplanting, one when the plant is taken up with the earth around it; the other when it is removed with its roots bare. The last is the plan followed in Europe, where the young mulberry is removed in this way, when about three years old, from the "vivajo" or second nursery, to the fields.

I tried this method at the commencement of my proceedings in this Country, but without success, owing to the bad management of the Natives. For though I contrived a small implement for burying the roots without injury, yet these were always found to be cut, and materially injured. I have since therefore generally adhered to the mode of removing with a quantity of earth. This I do when the plant is from three to four months old, and I have found it answers perfectly well.

The other system however is deserving of careful trial, as it is one well adapted for this Country. It is in the first instance, more economical, because the plants could be left for two years planted close in a second nursery, and as less ground would thus be occupied, the irrigation would not be so expensive, the proprietor also could for these two years, use for other purposes, the land destined to receive the trees.

Hereafter too I trust when the Natives begin to devote themselves to the cultivation of the mulberry, they will soon acquire sufficient practice for performing the operation of removal, without injury to the roots.

My own experiments, I must add, were in the first instance unfortunate, principally on account of my being very hurried, and having to transplant a great number of trees at once, and to employ people who were quite unacquainted with the process,

I have again in this year tried with a small quantity of trees and have succeeded well. The trees so transplanted are thriving exceedingly well.

The operation of transplanting would be better effected in the afternoon, so that the young plants would not be injured by the strong heat of the sun. If it is done in the monsoon, care must be taken that the holes made for receiving the young trees do not contain water, and are not too damp. If this is the case, the plant suffers; as the earth with which the holes are filled up, instead of being loose and soft, becomes hard and impenetrable.

The manure should be examined before it is applied to the young mulberry after transplanting and it should be properly matured. Transplanting is an operation requiring all the attention that can possibly be given to it, as on its being properly performed, the prosperous growth of the tree very much depends.

The best seasons for transplanting are the beginning of September and May.

Transplanting with Earth.

In transplanting, the mulberry proceeding from slips should not be removed till it is three or four months old. It should be taken from the ground with soil not less than 12 inches in depth. While placing it carefully in the hole prepared for it, the earth must be so far removed as to discover the roots. Of these all at the bottom are to be left, and their extremities only cut horizontally, and not obliquely: all the others above are to be taken away, being cut close to the stem.

After three months the ground will have to be dug, and a similar cutting again performed upon such roots as shall be found to have spread.

By cutting the roots in this way, several advantages are obtained. The tree becomes stronger, and has a finer and more regular appearance. The roots being all below are not liable to be injured by the plough, or by the heat of the sun, during the hot season.

The holes made for receiving the young plants, must be filled up with earth taken from the surface of the ground, and not with that taken from the holes themselves.

In irrigating, after transplanting, care must be taken, that the earth around the plant is not pressed with the feet. It should, on the contrary, be left loose, and there is no disadvantage in a considerable absorption of water.

The young trees should be planted at the distance of not less than 20 feet from each other. An opportunity is thus afforded of sowing grain, or planting vegetables in the intervals between the trees, but this should never be done till the trees themselves have reached the age of three years.

Transplanting without Earth.

In this operation, the holes made for the reception of the trees, should have additional channels leading from the main body of the roots to receive the long farms, as it is very important to place them properly so as to avoid cramping.—The extremities of the roots are to be cut as before described, and only one circle of them left below.

1. As some hours are required, transplanting one tree, care should be taken to protect in some way these roots which lie already exposed to the heat of the sun, either by covering with earth or cloth.

2. If any root has been injured, it should be removed, or it becomes rotten. The roots should be carefully divided and put straight according to the direction of each, and in filling in the earth, care must be taken not to disarrange them.

3. Except in the hot season, the trees dug up with the roots can be conveyed 5 and 6 days' journey, but they require to be packed up properly with grass, and refreshed on the way with sprinklings of water.

Hedges of Mulberries.

If these are properly cultivated, a great quantity of leaves, for the young Worms may be obtained from them. From one

hedge of the St. Helena species 306 feet long, and only a year planted, I obtained at one gathering, one hundred and fifty Pucca Seers of leaves, and next year I expect a deal more from it.

For the purpose of making hedges, a trench should be dug two feet broad, and as many deep. In this manure and water should be first put, and then the slips are to be planted in it, at one foot distance from each other. When these arrive at about twelve feet high, they are to be cut at two feet distance from the ground. After six months they must be cut again at the same height.

Leaves from these hedges, are to be gathered in the same way as those from the tree, and they should be pruned twice a year, in March and August.

The Rearing of Silk Worms.

This wonderful insect, thrives remarkably well in the Deccan. The eggs from which it proceeds, are here hatched all the year round by the heat of the climate alone, without (as in other countries), the necessity of artificial means. The regular time required for hatching is 9 days, except in the cold and hot weather, when it generally takes 12 or 15 days.

The only proper food of the silk worm is the leaf of the mulberry.

From the middle of June to about the middle of October, the worms may be kept in rooms with all the windows and doors open, and during that period they thrive capitally.

From the middle of October until the beginning of November, the weather is generally too hot for them, and from 11 to 4 o'clock in the afternoon, the place in which they are then kept should be closed, and in some mornings at the end of the same month likewise, when it is cold. In the greater part of November the weather generally agrees with them; but from about the end of November or commencement of December, to about the middle of February, the prevailing cold affects them. At this time

therefore it will be necessary to light fires from 10 o'clock at night till 9 next morning, when the rooms may be opened. At this period, as well as in a part of October and November, the progress of the worms is but slow; they take a longer time to spin, and they do not form very good cocoons. It might be easy to obviate this, by keeping up large and regular fires, which I have never here tried, as is done in Europe; but as we have abundant time during the other seasons of the year, it is not necessary to rear worms in the hot and cold season, nor would it be proper to gather the leaves frequently in the hot, and worse still during the cold weather, as it might be fatal to the tree.

From the middle of February to the end of March, the worms can be reared with tolerable success. From April to about the middle of June, unless great precautions are taken, the great heat kills the worms. They are all of them most liable to perish during the period of hatching. If they survive over that, we may hope to save most of them. The greatest care is necessary, especially at the first and last stage of their growth.

The following is the method I have generally followed in managing them during the hot season.

I keep the baskets containing the worms in the lowest divisions of the frames. I place beneath, earthen pots filled with water, and once a day, at 12 o'clock, I also throw water all round the frames. During the heat of the day, I keep all the windows and doors shut, and open the whole of them as soon as the heat declines. By these means I am able to keep the temperature at from 85 to 92 degrees. This very extraordinary year (1837) on account of the heat, cold and rain, I have been unable to equalize the temperature so much. For some days the thermometer in the rooms rose to 98, and this was attended with a loss of about 15 per cent. of the worms. The survivors made but small cocoons.

I should think, that the system followed in Bengal, of keeping the worms in double baskets, in the hot season, the outside baskets being always kept wet with water, would answer better than mine, and I regret not having made the experiment. The temperature

most suitable for the worms is that of 75 degrees of Fahrenheit, but less, or an addition of a few degrees, makes very little alteration in their health, and this is generally the temperature in the monsoon.

When the worms are young, they should be kept warmer than when they grow older.

Persons intending to rear worms, should commence by calculating the quantity of leaves they can obtain, in order to ascertain the number of eggs that may be required. They must bear in mind that it is far better to be deficient in worms than in their supply of leaves, for it is not only the quantity of these, but likewise their quality that must be attended to, if the insects are not provided regularly with the necessary quantity of proper food, the cocoons produced by them will be very poor; consequently, double the quantity of them would be required to furnish the usual proportion of silk. Moreover, a greater number of people are required to attend the worms, and finally, we may be compelled, for want of leaves, to destroy many, or even the whole, of the insects.

Method of Rearing the Worms.

The paper or cloth containing the eggs, is put into baskets, and these are placed in a frame-work fitted up in the room designed for the rearing, (vide Appendix).—As soon as the eggs are hatched, tender leaves are placed over the young worms, upon which they are immediately seen to climb. Particular attention is requisite in doing this. The leaves should not be applied until it is perceived that all the eggs are hatched, (or the greater part of them,) as they generally are on the same day.

The worms are next removed with the leaves into a second small basket, which is to be lined with paper.

Too many worms must not be suffered to climb upon the leaves, and very great care should be taken to remove them in time, as this is a most important object to prevent their being crowded.

The worms removed in the afternoon are not to be mixed with those of the morning, for though there be only an interval of a few hours, much difference is observed in the growth of different sets.

The meals for the worms are to be regulated as follows:

For the hot season.	*To be fed.*
1st stage, ...	6 times in 24 hours.
Remaining stages, ...	5 do. do.
During other season.	*To be fed.*
1st stage, ...	6 times in 24 hours.
2nd do.	5 do. do.
3rd and 4th do.	4 do. do.

To be fed day and night, every four, five and six hours regularly.

In the first stage, tender leaves finely chopped, should be selected ; as the worms advance, the chopping may be dispensed with, and the leaves cut with a knife ; and at the last stage, they may be given entire.

If any of the worms are observed to have a greater appetite than others, their supply of food should be proportionally increased.

The worms are liable to sickness or change of skin. Some are sick three, and others four times during their life, and remain so for about one and a half to three days. At this period they should not be fed. Commencement of their sickness is easily known by the following symptoms. They turn yellow, many of them remain under the leaves, others continue motionless, with their heads elevated, and some crawl from the centre of the basket to its edges. When they are recovering, it is observable by their becoming whitish and in motion.

As the worms never eat all the leaves provided for them, a portion of these remain with their litter, and as it would be injurious to the worm to allow it to continue in an uncleanly state, it becomes necessary to remove the insects every four days into clean baskets. This is always done by putting leaves upon them.

It is a matter of the greatest consequence to give the worms extensive room for their growth. As they increase in size, therefore, the number in each basket must be reduced. The contents of two baskets must after a time be distributed into three, then four, and so on, especially after the 4th stage, when they very rapidly attain their largest size, and it is also at this time that they require the greatest quantity of leaves. They ought never to be removed when sick.

The care of feeding the worms should always be entrusted to one and the same person, the duty being a most important one. Practice soon teaches the proper method of distributing the leaves, on which a great deal depends. The unpractised are apt to distribute the leaves unequally; giving to some too many, and too little or nothing to others. If too much be given, there is a waste of leaves; and by giving less than the necessary quantity, the worm suffers; hence the worms advance unequally in their growth and one of our great objects is thereby defeated, which is to have all the worms pass through the various stages of their existence together.

The leaves, except in the hot season, should not be given during the day, immediately after being gathered, but kept for a few hours. They ought then to be separated, and the tender given to the young worms; the hard to the more advanced, and the hardest and from the older trees, to those in the last stage of their growth.

Great care ought also to be taken of the leaves that are gathered, especially those in the afternoon, for use during the night. They should be so kept as to prevent any fermentation occurring by their being heaped together, which would materially injure the insects. They should also be kept from exposure to the wind, lest they become too dry.

They may be placed in baskets, but not subject to pressure; or they may be kept in clean ground, all damp being avoided. Wet leaves ought never to be given to the worms. During the rains they must be dried before being used, by partial exposure to the wind. Even if they should not become dry before the time for distributing arrives, it is better to wait some hours for

their proper drying; for to give them in a wet state would infallibly injure the health of the worm. Except in extraordinary monsoons, little delay is likely to occur in the Deccan from this cause, as there are always intervals of fine weathers when the leaves can be gathered dry. At this time if requisite, they can even be collected a day before they are wanted.

There is a variety in the color of the cocoons spun by the worms. Some spin a white cocoon, others a yellow, and others a sulphur or green one.

The time they occupy in coming to maturity for spinning also varies. Some commence spinning in 21 days, others in 29, others again in 35. According as these discrepancies are ascertained, the worms should be separated, and kept in different baskets.

The silk worm takes a few more days to spin during the cold and hot seasons, than it does in the temperate; nor is it then so strong either in constitution or appetite.

There is a difference observable in the constitution of the worms, according as the color of their cocoons varies.

It is only about a year and a half since I commenced rearing those that spin the white and yellow throughout their four stages. They eat more than the one making the sulphur cocoon, but there is a saving on the other hand in the quantity of food they consume, from the circumstance of their continuing about three days sick, whereas the latter is only about one and a half.

The white is very delicate and requires much attention. At the commencement of my operations I could only procure small and poor cocoons from them, and their eggs required a long time for hatching, and then not altogether, but they have since gradually improved. I attribute this improvement to the great care that has been bestowed upon them, as well as to the worms becoming better acclimated. I confidently expect a still further improvement.

The worm from which a yellow cocoon is spun, is also delicate, but not to such a degree as the above species. I had similar trouble with this worm at the beginning, but the improve-

ment in the size and quality of its cocoons has been latterly very considerable.

The worm spinning a cocoon of a greenish color is more hardy than the others. It is better able to withstand changes of heat and cold. Its eggs are also more regularly hatched.

Throughout the year they come to maturity in 9, 12, and 15 days, and unless there is neglect, we may be certain of having good Cocoons from them.

The three species of worms here noticed are, as to external appearance, little distinguishable from each other; but close observation will detect a difference.

When the worm is ready for spinning, it is seen to change its color and become yellow and transparent. It refuses all food, elevates its head, and keeps continually moving its body, as if uneasy.

This change takes place at night, and generally continues from 12 o'clock till 10 the next morning. This is not always the case, however, for in the cold and hot season they may be seen to begin to turn yellow and increase in color throughout the day.

Before they begin to spin it will be necessary to make some preparation for their conducting the process with ease to themselves. The assistance to be given to them is this. Cut small flexible slips from the bushes or trees, and tie them up into small bundles not too thick or broad, and hollow. These as soon as the worms are ready for spinning, are placed within the circumference, and in the middle of the baskets, so that the worm may easily creep into them and commence its labors; the majority will do this of their own accord, others require to be lifted and placed within the bundles.

In India the practice is to lift *each worm* separately, and place it in a basket having its divisions, wherein the spinning is to proceed. This practice has several very great objections. It is very tedious and expensive, requiring the assistance of many persons in

lifting so many worms, besides the cost of the requisite number of baskets, and the space they necessarily occupy.

The operation also takes so much time, that before all the worms can be collected and arranged, part of them lose their strength, and form small cocoons, and some form none at all, and this may be attributed also to want of care and skill in selecting worms that are not yet ready for spinning. Therefore, the best and indeed only plan, that should be followed, is the European method of bundles, which is both very economical and convenient; but to do that, it is absolutely necessary that the worms should be properly reared, in order, that they may be all equally prepared for spinning. This process indeed ought to be in progress among the whole in two days or early on the third, and not be going on for six, eight and ten days (and more) as is not unfrequently observed in India.

It is also requisite to guard the worms against external injuries by giving them in charge of a person early every morning, whose duty should be to fill up the stones or coondies of the frames with water, for if this is neglected the worms will be destroyed by the ants, as they are found in great quantity. For their greater preservation, ashes should be spread around the coondies. The worms are also liable to be destroyed by rats. Every strong narcotic odour, particularly the smell of tobacco, is very likely to prove injurious to them. No smoking therefore should ever be allowed among the Natives' assistants in the rooms where they are kept.

They are very sensitive to the changes in the weather. It might hence be advisable to endeavour to keep them, as much as possible, in a regulated temperature, which should be preserved always the same. It will be necessary however, to take such care on this point, as always to open or shut the door and windows, according as they become exposed to the sun, or a cold breeze, or may require, on the other hand, more air. This, when it is not too cold or hot, must be allowed, and when the insect has begun to spin and cover itself up, a greater supply of fresh air is beneficial.

During the six years that I have reared worms in Poonah, they never once had a disease.

I conclude this subject by strongly recommending great cleanliness to be observed in the treatment of the worms, as also, in the place where they are kept, which ought to be freely ventilated in order to remove all bad smells which cannot fail to be hurtful to so delicate an insect.

Cocoons.

The Cocoon is a species of kernel or nut formed by the worm.

Upon every basket in which worms are spinning, a piece of paper should be placed with a memorandum of the day when the process of forming the cocoons commenced. We thus know when to remove the cocoons, as this should be done on the fifth day. On the third day generally, sometimes on the fourth, the insect has accomplished its labor and passes into the state of chrysalis.

The cocoons of different colours must, under every circumstance, whether intended for breeding or winding, be separated and kept a part, from each other.

When selecting cocoons, to obtain worms for producing eggs, the largest and hardest should be chosen.

The Cocoons contain either male or female moths. The former are distinguished by being smaller than the others, more pointed at one or both ends, and depressed in the centre, and the latter are generally more round and full, and without ring or depression in the middle.

It is necessary to have an equal proportion of male and female moths.

On the 9th, 12th and 15th day, according to the season, and as I have already mentioned when treating of the hatching of the eggs, after the worm has begun to spin, the cocoon is pierced, and the moth issued.

The male moth is easily distinguished from the female. The first is smaller, and it is continually in motion, the last is larger

than the male, and moves very little and slowly. The two sexes must be put a part for a few hours, and afterwards one of each sex should be placed together for 6 hours, when they are to be separated, and the female placed upon paper or cloth. Although they have wings, these butterflies do not fly. In the afternoon of the same day and during the night, all the eggs will be laid.

From July to October we can calculate on 180 to 280 eggs from each moth. In the hot and cold weather, if proper precautions be not taken, about half of this quantity only will be produced.

This quantity, I have no doubt, of being by and by able further to increase. At the commencement of my labors I was unable to produce one half of the above quantity. In Europe they get from 230 to 400.

The moth requires no food.

After copulation, the males may be thrown away, except when the number of females happens to be in excess, as this is the case sometimes. When this takes place, the best males should be selected to make up the necessary quantity, and separated one hour earlier, than the others, from the first set of females to which they have been attached, and then applied to the second set.

Every endeavour must be made to keep the eggs in as temperate a place as possible.

It requires at present about 22,000 to 24,000 eggs to form one tola weight, or 12 Poona massah, of the abovementioned species. As we improve, of course the eggs will become a little larger and will require less to form the tola, but the difference will not be great.

The insect contained in those cocoons, from which we intend to wind silk, must be destroyed before it makes its exit. If this be not done, the aperture left by it as issues forth, spoils the cocoon for our purpose, for as soon as these are placed in water, they sink to the bottom of the pan, from fluid being admitted, and the texture of the cocoon is injured.

There are three plans of destroying the insect, while in the cocoon. The first is by exposure to the heat of the sun, the second by baking them, and the third by steaming them.

In the first method the cocoons are to be exposed to the sun for one or three days, according to the season. This system cannot be always followed during the monsoon on account of the rain, and from the days being cloudy. It is also liable to the objection, that the yellow and sulphur or green cocoon from such exposure loses its color, becomes pale, and the silk wound from it, is not so glossy.

The second is a more speedy one, and to which I give the preference, but it has also two objections: the first, from the cocoon becoming too much baked, the fibres of the silk are burnt, and in winding, the threads break, there is great waste and the silk comes off imperfect. And secondly, if it is insufficiently baked the moth is not destroyed and still makes its exit.

This operation can be done in an oven or by a trench in the ground two feet deep, and of an extent depending upon the scale of operations. The trench should be built up with pukkah bricks and chunam.

A fire should then be made in it which must be carefully attended to and kept burning gently. Over the trench should be stretched a kumblee, in which the cocoons are deposited in close and regular order, care being taken not to huddle them together in a mass.

The heat must be well regulated and the cocoons turned from time to time. In about an hour and a half the insect is suffocated. Two pukka seers of coal are sufficient to bake 8,000 cocoons.

The process of destroying the insect by steam, is a certain one and effected in about one hour, but in employing it, we should take great care before doing it, that the cocoons have no leaves or dirt attached to them. One cocoon in a dirty or unclean state will always injure any others in contact with it. Great attention is also required in placing them upon the frames that the baskets or whatever may be used, be perfectly clean, to prevent their

contracting dirt, which they are the more liable to do from being taken wet from the steam.

The color however and gloss of the silk from such process, is rather inferior to that produced from the cocoons that are baked.

Whatever method may be adopted with the cocoons, it is requisite to pay attention that the damaged ones be prevented from mixing with the others in the process, and for the first few days, that too many be not placed together, but filled up not higher than 2 or 3 inches, and be in a place to have free ventilation. They should be turned 3 times a day. As they become gradually more dry, the pile may be raised, and the process of turning limited to twice a day in the first instance, then once, and finally omitted.

The weight of my best sulphur and yellow cocoons, five days after the worm has begun to spin, and before being baked, has been, for 5000 cocoons, pukha seers (of 80 rupees each) 5 to 5⅝ From one maund there should be produced more than three seers and a half of fine silk, with such cocoons.

Winding Raw Silk.

Experience has already shown that the Natives of this country are, from their habits and dispositions, particularly qualified for the work of winding silk, although so trifling a quantity has as yet been produced in the Deccan that they have not had sufficient practice, which is the principal requisite for performing this operation.

The first thing to be attended to previous to beginning to work, should be to get good and dry fire-wood, so as to facilitate your having the water in the copper-boiler always at the same degree of heat, which is a very great object, as contributing to produce good silk and preventing an extraordinary waste of cocoons.

The quality of the water to be used in winding from the cocoons is also an important matter. The lighter the water the better. It should be kept in an earthen jar with some small round *river* stones

and a few cuttings of vines, and exposed to the sun for two days before being used.

In about 5 to 8 days after the moth has been destroyed you may commence winding the silk. It should not be done earlier, as the cocoons being too fresh, the winding would not proceed well, neither should it be delayed too long, for then the fibres are liable to become too brittle.

In the first place the cocoons are divided into different assortments, according to their qualities.

1st. Those of the best qualities.
2nd. Of a middling quality.
3rd. Of a bad.
4th. Of very bad and damaged.
5th. Of the double, that is to say, such as have been spun by two worms and which contain two moths. These are very easily distinguished.

Before commencing reeling a preliminary operation also has to be performed in regard to the 1st, 2nd, and 3rd qualities, which is, to take off the floss or the first skin covering the outside of the cocoons.

In winding the cocoons, those of the worst qualities may be used first, as the best can remain longer without injury, even more than 40 days, except those of *white colour* which if kept too long causes the silk to lose its whiteness they should therefore be wound early.

Although the thread of wound silk appears so fine, it is not a *single*, but in reality consists of *several* fibres, as the single fibre would never be strong enough for any purpose.

The smallest number of cocoons that can be used together in winding, in order that their united fibres may form one thread, is three. The greater the number of fibres joined together, the more coarse will the silk become.

It must be observed, that the fibre of the cocoon, as it approaches to an end, becomes finer when two of them can be

considered only as equal to one fresh, therefore the person winding must be particularly attentive to adding a greater number of new or old cocoons, and calculate according as he finds it necessary. Practice in this, (which is a point of great importance) as indeed throughout the whole process, can alone point out the proper way.

The requisites for producing perfect silk and the attention required towards it, are the following:—

1st. To have good cocoons.

2d. To brush them properly.

3d. To preserve the water always at the same temparature about 15 degrees below boiling heat, a greater or less degree to depend on quality of the cocoons, for the harder the cocoons are, the hotter must the water be to dissolve the glutinous matter that exists in them.

4th. To have clean, pure and light water.

5th. To keep the reel performing its revolutions regularly, and not at one time with a quick, and another with a slow motion.

6th. The silk to be cleared properly from nibs and uneven threads; and finally and most essentially, to have an attentive person to wind.

The characterestics of perfect silk are evenness of thread, cleanliness or freeness from nibs &c. purity of colour, glossiness, softness, and being well twisted.

About 250 cocoons may be put in the pan when the water is at the proper heat; according to the quantity of fibres the silk is to be wound of whether fine or coarse and the ability of the reeler to do it quickly or slowly. as the cocoon must not be kept long under the process.

After the cocoons have been brushed, to loosen the fibres, they should be kept always close to the reeler, on his own side of the copper-boiler, and those that are at work should be kept separately, so that he may be able exactly to distinguish the number going on.

When the thread breaks, the reel should be stopped and the extremities of the thread joined, not with a knot but by twisting them a little with the fresh ones, as I do. If a person is at first unsuccessful (although it is not a difficult thing) let him place it under the skein to which it belongs.

The reeler must refrain from contracting the habit to which many are liable, of twisting in his hands the fibres when fresh cocoons are required to be added, as it would be wasting silk.

He must not neglect to make as many crosses as he can, the number of which, more or less depends on the quality of the cocoons and to see it going on, as sometimes it slips, and in that case he must stop the reel and put them again in order.

Every time that the cocoons placed in the pan have been reeled, the silk should be cleaned of its nibs &c. and the boy should take out all the grubs remaining in it and see the fire properly lighted.

At 12 o'clock the water remaining in the pan is thrown away, and replaced with fresh water for the afternoon.

The reeler should from time to time sprinkle cold water over the iron holes through which the thread passes, from a basin that he should have close to him.

During the days of heavy rain it will be best to discontinue the winding of silk, which is then liable to suffer in its glossiness and colour. The rains in the Deccan are however rarely so heavy throughout the whole day, or the atmosphere so close as to cause much interruption.

The Italian machine (which I use) requires two persons. One at the pan, and the other (a boy or woman) to turn the handle of the reel. It requires two reels, one of which may thus be removed at 12 o'clock along with the silk reeled in the forenoon, while the other is placed for the afternoon. In this manner the silk dries better, and we have also the opportunity of examining the first more at leisure and of removing all impurities.

The white silk is the finest and best, next the yellow, and then the sulphur.

As regards the quantity of silk that can be reeled in a day, I have had a native man wind one pukka seer of silk of $\frac{10}{12}$ cocoons in 3 days, and a woman in two. I prefer the women and would recommend them, for although there can be no doubt that a man could do as much as the other, yet, the women require less wages and are otherwise less expensive.

The length of the skein adapted for Europe is 36 inches; for this country it varies.

The quantity of firewood consumed in a day, in a furnace, is about 15 seers. The quantity however depends, in a great measure, on the furnace being properly built.

The best result I have as yet obtained from the cocoons, has been a consumption of 9,240, 10,080, 10,500, to 11,000 for one pukka seer of fine silk.

APPENDIX.

MEMORANDUM.

Of the size and quantity of Leaves of a Plantation of Mulberry Standard Trees, of the age of 26 months, of the St. Helena species; proceeding from cuttings planted in black soil at the distance of 16 feet apart, at Clare Bagh, as per certificate to the Principal Collector of Poona, according to which it will also appear, that the Leaves were gathered when some had fallen off the Trees, and many of those remaining had become dry.

Date.	Trees.	Circumference of the Stem. The branches where divided.	Circumference of the Stem. At the bottom.	Height.	Quantity of leaves in one gathering.	Witnessed by.
1837.						
September 23	1	Ins...15	Ins... 18½	Feet, 18	Pucka Seers. 17	Messrs. H. Coldsmid, H. Rudd, M. Browne, and McIntyre.
,,	1	do... 17	do... 19 ½	do... 17 ½	do ... 18	
October.... 9	1	do... 11 ½	do... 13 ½	do... 16 ¾	do ... 9	Ragoo, Seedashew, and Bageewa Gazanah Bramins.
,, ... 14	1	do... 16 ½	do .. 17 ..	do .. 18 ..	do .. 18	Superintendent Mr. Browne.
,, ... 15	1	do... 10 ¼	do .. 13 ..	do .. 16 ..	do ... 7 ¾	Kassecenath Soonhar, & Bageewa Gazanah Bramins.
,, ...	1	do .. 14 ¾	do .. 16 ½	do .. 17 ..	do ... 15 ½	
,, ...	1	do... 13 ¾	do... 16 ¾	do .. 18 ..	do ... 16 ..	Cheemagee Ballahar Bramin.
,, ... 16	1	do... 14 ..	do... 16 ..	do... 18 ..	do ... 16 ..	
,, ... 17	1	do... 16 ..	do... 17 ..	do... 17 ½	do ... 15 ½	
,, ...	1	do .. 14 ¾	do... 18 ..	do... 17 ..	do ... 16 ¼	
,, ...	1	do... 14 ¾	do... 17 ..	do... 18 ½	do ... 18 ..	
,, ...	1	do .. 13 ..	do... 14 ..	do... 16 ¼	do ... 11 ¾	
,, ...	1	do... 14 ..	do... 16 ¼	do .. 18 ..	do ... 18 ..	
,, ...	1	do... 14 ½	do... 17 ..	do... 17 ¾	do ... 16 ¾	
,, ... 18	1	do... 13 ..	do... 16 ¾	do .. 17 ¼	do ... 13 ..	
,, ...	1	do .. 14 ..	do... 16 ¾	do... 17 ¾	do ... 14 ¼	
,, ...	1	do... 13 ..	do .. 15 ¾	do... 18 ¼	do ... 15 ¼	
,, ...	1	do... 13 ¼	do .. 15 ¾	do... 18 ¼	do ... 15 ¾	
,, ...	1	do... 15 ..	do... 18 ..	do .. 18 ¾	do ... 17 ..	
,, ...	1	do .. 15 ¼	do... 18 ..	do... 19 ..	do ... 18 ..	Shamrow Gowna, clerk, sent by the Principal Collector.
,, ... 19	1	do... 15 ..	do... 17 ..	do .. 17 ¾	do ... 18 ¾	
,, ...	1	do... 15 ¾	do... 18 ¾	do .. 17 ¾	do ... 16 ¾	
,, ...	1	do... 17 ¼	do... 17 ¼	do... 18 ¼	do ... 17 ¾	
,, ...	1	do... 14 ¾	do .. 16 ¾	do... 17 ¾	do ... 14 ¾	
,, ... 20	1	do... 15 ..	do .. 18 ..	do... 18 ¾	do ... 15 ¾	
,, ...	1	do .. 16 ..	do... 17 ¼	do... 17 ¾	do ... 15 ¾	
,, ...	1	do... 15 ..	do .. 18 ..	do... 18 ¾	do ... 15 ..	
,, ...	1	do... 16 ..	do... 19 ..	do .. 18 ¾	do ... 15 ..	
,, ... 21	1	do .. 14 ..	do... 16 ..	do... 15 ¾	do ... 14 ..	
,, ...	1	do... 15 ..	do... 19 ..	do .. 17 ¾	do ... 14 ..	
,, ...	1	do... 14 ..	do... 16 ¾	do... 17 ¾	do ... 13 ..	
,, ...	1	do... 13 ..	do... 16 ..	do... 17 ¾	do ... 12 ..	
,, ... 20	1	do... 15 ..	do... 17 ¼	do... 18 ..	do ... 13 ¾	Kassecenath Soonhar, and Bageewa Gazanah Bramins.
,, ...	1	do .. 16 ..	do... 18 ..	do .. 18 8	do ... 14 ¼	
,, ... 24	1	do... 14 ..	do .. 16 ..	do... 15 ¾	do ... 14 ..	
,, ...	1	do... 16 ..	do... 19 ..	do... 17 ..	do ... 13 ¼	
Trees... ...	36			Total, Pucka Seers.....543		Or an average of 15 1/8 pucca seers for each Tree.

* The two Trees that on the 23rd of September, were plucked and pruned, had on the 25th October, again fresh Leaves and Branches. They had not been watered, neither did rain fall after the 4th October.

(Signed) H. RUDD, Supt. Police Corps.
M. BROWNE, Supt. Bazar.

In Poonah there are some Trees of the "Shah" species, for the Leaves of which three times a year I should be happy to pay 7, 10, 12, and 15 Rupees each per annum.

Note—"At the end of the sixth spring 1000 Mulberry Trees will on an average yield each 12 pounds of Leaves."—*Count Dandolo, page* 353.

"It is considered that a well cultivated Mulberry Tree should yield in each season about thirty "pounds of good leaves. It is not uncommon in the South of France to see large Trees which will "furnish five times this quantity."—*Lardner's Cyclopædia*, Treatise on Silk manufacture, page 103.

STATEMENT OF TWO EXPERIMENTS OF COCOONS MADE AT KOTROOR BAGH, AS PER CERTIFICATES SENT TO THE PRINCIPAL COLLECTOR OF POONAH.

One of sulphur or greenish Cocoon-wound Silk, the consumption of Cocoons having been 10,080 for one pucka seer of Silk. (*a*)

Poonah, 23rd September 1837.

Witnessed by Messrs.
H. RUDD, Lieut.
Supt. Police Corps.
M. BROWNE,
Supt. Bazar.
H. GOLDSMID,
Assist. Collector.
L. M. McINTYRE,
Lieut. and Adjut. E. R.

Another experiment of yellow Cocoons, consumption being from 10,500 to 10,850.

Witnessed by SHARROW GOWNAH,
Clerk to the Principal Collector.

RATES OF WAGES FOR PEOPLE, BULLOCKS, &c.

1	Man...	* Per diem, Pice	8 to 10
1	Boy	Do.	3 „ 6
1	Woman.	Do.	4 „ 5
1	Plough with 4 Bullocks... ...	* Per diem, Annas	10 „ 12
1	Do. 2 do	Do.	6 „ 8
1	Harrow „ 2 do... ...	Do.	5 „ 6
1	Mot. viz, 4 do. with leather bucket, ropes and one man for drawing water	Do.	8 „ 12
1	Cart with 4 Bullocks	Do.	8 „ 12
1	Man	Per mensem, Rs.	3 „ 4
1	Boy.	Do.	1¼ „ 2
1	Woman.	Do.	1½ „ 2
1	Mason.	Do.	8 „ 12

(*a*) One maund of Cocoons, before being baked, will produce very near 4 seers of silk.

* 16 annas, or 80 pice, for a rupee.

1	Carpenter.	Per mensem, Rs.	9	to 15
1	Mot.	Do. ...	13	„ 15
1	Bullock with puckal (leather bucket) and a man to irrigate.	Do. ...	6	„ 7

Remarks.

A Man in one day will dig four to seven holes of 2½ feet square and 2 deep, according to the nature of the soil.

With one Mot, one Beegah of Land containing 140 Trees. planted close to a Well, can be irrigated in 3 to 6 hours, with 2 Mots (eight Bullocks) according to the depth of the water in the Well, (*a*) and the season of the year; as in the hot weather a longer time is of course required on account of the dryness of the earth absorbing a greater quantity of water, along the water courses.

ESTIMATED EXPENSE OF A BEEGAH (20¼ ENGLISH FEET SQUARE) OF LAND PLANTED WITH 140 MULBERRY STANDARD TREES OF THE ST. HELENA SPECIES FIVE YEARS AFTER PLANTATION IN THE FIELD.

Expenses for the Nursery.

For preparing the ground and manuring, ...	Rs.	2	0 0
Cutting the slips and planting...		0	1 0
Irrigation, for 4 months...		3	0 0
Weeding...		1	3 0

Expenses in the 1st year.

Ploughing and harrowing...		4	0 0
Digging 140 holes and making water courses. ...		3	0 0
Transplanting...		1	0 0
Manure...		2	0 0
Hire of Bullocks for irrigating, from June to September, 4 months, required only when the monsoon is scarce...		3	0 0
Ditto from October to the end of February		7	0 0
Ditto „ March „ May		4	0 0

(*a*) In the Ahmednuggur District the generality of the Wells have water close to the surface.

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Digging 4 times a year ... ... Rs.	2	2	0
A person to irrigate occasionally	3	0	0
Ditto to prune and thin*...	0	0	0

The 2nd year.

Irrigation from June to September, as above	3	0	0
Ditto from October to February...	7	0	0
Ditto „ March to May	4	0	0
Ploughing and harrowing	4	0	0
Digging 4 times	2	2	0
Manure	2	0	0
A person to irrigate...	3	0	0
Ditto to prune and thin...	0	0	0

The 3rd year.

Irrigation from June to September...	2	0	0
Ditto „ October to February	6	0	0
Ditto „ March to May	3	0	0
Ploughing and harrowing	3	0	0
Digging 3 times	2	0	0
A person to irrigate	3	0	0
Manure...	2	2	0
A person to prune	0	0	0

The 4th year.

Irrigation	9	0	0
Ploughing and harrowing	3	0	0
Digging twice	1	2	0
Manure	2	2	0
A person to irrigate...	3	0	0
Ditto to prune	0	0	0

The 5th year.

Ploughing and harrowing	3	0	0
A person to prune	0	0	0

* The wood obtained by this operation will pay for the labour and leave some surplus,

Incidental expences	Rs.	6	0 0
Rent of the land for 5 years		25	0 0
Contingencies		23	2 0
	Rs.	160	0 0

Remarks.

The utmost cost of one Tree would be 1 Rupee and 11 pice; ut even this would be only for certain places, because:

1st. Trees planted in Gardens where water generally runs for irrigating the vegetables that the ryots are in the habit of sowing, will require no additional expense.

2nd. There are a great many Gardens in the Deccan that after the monsoon is over, are supplied with water from streams or Rivers for several months, and some of them for the whole year. In such situations there is very little expense incurred for irrigation.

3rd. Should the plantation belong to a ryot, the greater part of the expense of cultivation would be saved by the employment of his own family, who are generally the greater part of the year, totally unoccupied.

PROBABLE COST OF ARTICLES REQUIRED TO REAR SILK WORMS.

1 Teak wood frame, measuring 5½ by 3½ feet, composed of 4 upright posts 7½ to 8 feet high, joined together by 4 cross bars at each end, of strength sufficient to support a man's weight, the first of these, to be placed at a distance of about 1½ feet from the floor, and the others at a similar distance from each other; then 6 bamboos are to be fixed along each side the frame, which will form six shelves, each to contain 12 baskets. The stout bars at either end, it will be seen, afford strength to the frame, and serve moreover, as a kind of ladder to step upon and feed the Worms in the baskets on the upper shelves. ... ...Rs.	2	2	0
12 large baskets measuring 4½ by 2½ feet quite shallow, and each basket capabale of holding 700 full grown Worms.... ... ... „	2	0	0
16 small round baskets for the small Worms... „	1	0	0

5 Stones *(Coondee)* to put under the legs of the frames to prevent ants from getting into the Worm baskets.	Rs.	1	0	0
1 Basket for leaves, to feed the Worms... ...	„	0	0	3
1 Chopper to chop the leaves	„	1	8	0
1 Knife to cut ditto	„	0	8	0
1 Light	„	0	8	0
1 Lantern	„	1	0	0
1 Plank to chop and cut the leaves... ...	„	0	2	0
1 Basket to keep leaves	„	0	0	10

Instead of baskets, boxes of thin plank might be made, which would save the expense of constantly renewing the baskets. The expense of providing boxes would in the first instance be great; but in the end, they will prove more economical, as they will last for a longer time.

PROBABLE COST OF MATERIALS REQUIRED TO WIND SILK.

1 Machine with a double reel from	Rs.	15	to	18
1 Copper boiler	„	6	„	8
1 Jar to keep the water used for winding the Silk.				½
1 Bason for cold water.				½

If desired, a very simple wooden wheel could be made which would enable one man to turn at once not only 10, but 40 machines if necessary, which are used in some places in Italy, (named *rottone*). Here however, wages are comparatively so low, that it is not worth while to do it, moreover the Boys can be usefully employed (as I employ them) during the evening in taking off the skin of the Cocoons to be wound the day after, which would be a saving of expense.

ESTIMATED COST OF ONE PUCKA (PERMANENT) BUILDING FOR REARING SILK WORMS.

Three feet of foundation—Nine feet height of wall, built of Stone—Eighteen feet broad—Three hundred and six feet long, 2 feet breadth of wall, and 12 feet height of roof, and plastered outside with chunam—Fourteen windows 4 feet high and three

feet broad—Two doors 5 feet high and 3 feet broad—The building to be covered with tiles and the windows of plank.

Estimated cost, from Rs. 1600 to Rs. 2000

ESTIMATED COST OF A CUTCHA (TEMPORARY) BUILDING FOR REARING SILK WORMS.

Half work of stone, and the remainder of Cutcha Brick, with a roof of grass chuppar, and the doors and windows of mat—The length, breadth, and height, the same as the pucka building.

Estimated cost, from Rs. 1200 to Rs. 1400.

ESTIMATED COST OF ARTICLES REQUIRED TO REAR WORMS PRODUCING 40 TOLA WEIGHT OF EGGS.

106	Frames, at 2½ Rs. each	Rs.	265	0 0
424	Stones, 5 or 6 for a rupee.		85	0 0
1272	Large Baskets, 6 for a rupee ...		212	0 0
640	Small Baskets, 16 for a rupee. ...		40	0 0
2	Choppers		3	0 0
4	Knives to cut the leaves		2	0 0
1	Lantern...		1	0 0
2	Lights.		1	0 0
4	Planks to cut the leaves.		2	0 0
4	Baskets for leaves to feed the Worms...		0	1 0
4	Do. to keep the leaves. ...		0	2 0
		Rs.	611	3 0

ESTIMATED COST OF ARTICLES REQUIRED FOR A PLACE CONTAINING 10 FURNACES FOR WINDING SILK.

10	Machines, at 18 rupees each	Rs.	180	0 0
10	Copper boilers, at 8 rupees each. ...		80	0 0
6	Jars to keep water.		3	0 0
10	Basons.		1	1 0
		Rs.	264	1 0

ESTIMATED COST OF A BUILDING TO WIND SILK CAPABLE OF CONTAINING 10 FURNACES OR MACHINES.

Stone and chunam walls eight feet high—fifty four feet long—fourteen feet broad—with eight plank windows and one or two doors	Rs.	250 to	400
Ten furnaces	„	60 „	65
Tubes formed of Tiles to take away the smoke.	„	20 „	25
	Rs.	330 to	490

Remarks.

Attention must be paid to the building of the furnace, for if it is not properly done, the waste of fire-wood will be great.

A very great improvement could be effected by introducing the system of reeling Silk from the Cocoons through steam by means of one large copper boiler which communicates the heat to the other boilers by tubes, by which the saving of fire-wood would be very great and the Silk wound with less inconvenience, and perhaps be more perfect than if wound otherwise.

The expense, in the first instance will certainly be great, but the benefit ultimately to be derived from it would soon repay the outlay. I have got a plan for an establishment of 40 furnaces.

ESTIMATED EXPENSE OF AN ESTABLISHMENT FOR MAKING SILK ON A LIMITED SCALE.

For a plantation of 6 Beegahs of Mulberry Standard Trees of the St. Helena species, 140 Trees in each Beegah, or 840 in all, the cost of 5 years cultivation &c. will amount, as per statement...	Rs.	960	0	0
A building for the Worms...	„	2,000	0	0
Articles for ditto	„	611	0	0
A building for winding Silk	„	490	0	0
Articles for ditto...	„	264	1	0
	Rs.	4,326	0	0

Expense of rearing the worms proceeding from Eggs of the weight of 40 Totals, say 900,000 of Worms.

Carried over, Rs. 4,326 0 0

Brought forward, Rs.		4,326	0 0
65 days' wages of one head man, at 8 Rs. per mensem..	17		
90 do. do. of men attending the Worms, at 3 Rs. per month	9		
480 do do. of women do. at 2	32		
340 do. do. of boys do. at 1½ ...	15		
Cost of Eggs	20		
Do. of gathering leaves	25		
Paper for the Worms	5		
Oil for the Worms' rearing place	6		
Tack (twine) to tie the bundles in which the Worms form their Cocoons... ...	5		
Charcoal for baking the Cocoons...	5		
Extra days wages of people employed in taking off the skin of the Cocoons for reeling...	20		
10 Persons employed with 10 machines in winding, at 4 Rs. per mensem	40		
10 Boys to turn the handles of the machines at 2 Rs. per mensem...	20		
Fire-wood	40		
Contingencies	25		
Rs.	284		
The same expense twice repeated, (allowing for winding 3 times a year,) deducting Rs. 30, for the cost of Eggs, Paper and Tack, which do not require to be renewed each time ...	508		
		892	0 0
Total expense in 5 years...Rs.		5,218	0 0

Remarks.

In Italy the selling of the Silk Worm Eggs is a distinct trade, followed by individuals who do not cultivate Silk. In the above estimate I have therefore, allowed an ample profit for the Eggs, which may be produced at an expense considerably under what I have allowed. For instance, each butterfly will deposit on an average 200 Eggs, and estimating 9 lacks as equal to 40

Tolas weight, 4550 butterflies would produce the above quantity; but as it is necessary to have an equal number of males and females, we must estimate 9,000 Cocoons as the quantity required for producing 40 Tolas of Eggs.

ESTIMATED RETURN OF SIX BEEGHAS PLANTED WITH 840 STANDARD MULBERRY TREES OF THE ST. HELENA SPECIES, 5 YEARS AFTER PLANTATION.

For the first four years as already stated, no attempt to make Silk should be made; but the sale of the leaves will produce as under:

The 1st year at 4 seers per Tree, being	3,360	pucca seers, at 50 pice per maund...	Rs.	52	
„ 2nd year, 8 per Tree,	6,720	at do.	„	105	
„ 3rd do. 10 „	8,400	at do.	„	131	
„ 4th do. 12 „	10,080	at do.	„	156	
					444

On the 5th year, each Tree will yield 20 seers of leaves, which will give 16,800 seers in all, sufficient to rear the produce of 40 Tolas weight of Eggs (about 900,000 Worms.) Estimating, therefore, 13,000 Worms as necessary for the production of one pucca seer of Silk, and 18 seers of leaves for the nourishment of 1,000 Worms;—234, or say 240 pucca seers of leaves will be sufficient for the production of one seer of Silk, making thus 70 pucca seers of Silk as the produce of the 6 Beegahs in one gathering of the leaves. In the monsoon, however, they can be gathered twice at least, so that the above quantity may be doubled. Calculating therefore the minimum price of the Silk at Rs. 12, (it varies in the Deccan from Rs. 13½ to 16,) 140 seers will yield. Rs. 1,680

For the rest of the year we may safely estimate the produce at 50 seers more, or, ... „ 600

Total return in 5 years, Rs. 2,724

Remarks.

In order to prevent the possibility of disappointment, I have, in the above statement, purposely under-estimated the probable return, as will appear from the following facts derived from my own experience in the Deccan.

1st. Trees 26 months old, have yielded 15 seers of leaves on an average; and others of 27 months, planted in stony ground, have yielded at different times 15, 16, 18, 21 and 23 seers, or an average of 18 seers each. Some again of 4 years, also planted in stony ground have yielded 30 and 35 seers. From the above therefore it will be evident that my estimate of 20 pucca seers, the 5th year after plantation, is considerably under what is likely to be the actual quantity each Tree will yield.

2nd. I have repeatedly made a seer of Silk of from 10 to 12,000 yellow and sulphur Cocoons, so that my estimate of 13,000 is more than sufficient to cover every contingency.

3rd. Sixteen pucca seers of leaves are generally sufficient for the nourishment of 1,000 Worms, while I have named 18 seers.

4th. I have altogether omitted the fluff, fruit, &c. in my estimate and these will always yield something.

It is therefore clear, that if the *first* return, even at my low estimate, amounts to so much, it will increase each succeeding year; so that, with the exercise of a little necessary patience, there are few more encouraging speculations to be entered into in this country.

ON THE INTRODUCTION OF SILK AND THE CULTIVATION OF THE MULBERRY, Under the Bombay Presidency.

FOR THE

AGRICULTURAL AND HORTICULTURAL SOCIETY OF WESTERN INDIA,

BY

CHARLES LUSH, M. D.

Superintendent Botanic Garden, Dapooree.

Having obtained permission from Government to publish a Correspondence regarding the introduction of Silk on this side of India, I will take the liberty of laying before the Society a few observations, with the view of making the public acquainted with what has been done towards this important object, what experience has been gained, what remains to be done, and what prospect there is for the future.—When it is stated that we are still in the stage of experiment,—in the *pupa state*, if I may be allowed the expression, and that there is not at this moment an establishment sufficiently far advanced to enable us to declare with an appeal to figures whether Silk will answer in the end as a Commercial Speculation: practical men must forbear any hasty conclusion, with regard to our imperfect information. Should a discussion of the subject lead to the attention of British Skill, and the application of British Capital to this staple, my object will be attained. It is now time to look beyond mere experiments.

The first attempt within my knowledge to produce Silk in the Deckan came from Mysore via Darwar. The Mulberries were cultivated in a rough way, a careless imitation of the Bengal plan, sometimes called the "bush system," for which as may be seen hereafter the real Bengal plan of Cultivation is not to be blamed, and really should any one wish to condemn the system followed on the other side of India, I must take the liberty of suggesting that he will first acquire a little more experience than any one in our Presidency now possesses.—Let the straggling Mulberry bush of four feet high be condemned as loudly as possible.—But the Bengal, on the one hand, and the Italian Standard tree system on the other, each resting on separate merits, must be investigated and experimented on farther before either can claim a decided preference. The *reel* used in the first Deckan experiments was said to be the common Bengal reel,—rather clumsy, like the imitation of the Bengalee Cultivation. It was in principle nearly the same as the Italian reel figured in Rees and Lardner's Encyclopædias.

The first Silk I find reported on, from this side of India was in a dispatch of the Honorable Court, 7th January 1831, upon some Silk produced at Darwar, the Ship in which it was sent having been wrecked the sample was damaged, but the observation is "had the parcel been in a sound state, the raw silk would have produced about twelve Shillings a pound."

About the year 1829—30 two Establishments were formed under the auspices of Government for the Cultivation of the Mulberry and production of Silk.—At Ahmednuggur Mr. A. Graham directed his attention to producing good Silk for Indian consumption, worked with the Chinese reel.

At Poona Mr. Mutti has been endeavouring to introduce raw Silk on the Italian plan, the worms to be fed on the leaves of standard trees and the Silk reeled with the Italian reel fit for the English market; his former partner Sorabjee Patell is now proceeding on nearly the same plan as that of Mr. Graham.

Soon after the establishment of these experiments the Court of Directors sent out from St. Helena the several kinds of Mulberry

growing upon that Island with eggs of two breeds of worms.—These were consigned to my care and divided chiefly between the two Establishments and subsequently sent on to Bengal. This having led me into correspondence with the other side of India, I sought for information through Government regarding the best mode of rearing and feeding the worms, the result of which I now communicate. Having first ascertained that the existence of the Italian White Mulberry with white fruit was rather doubtful on the other side of India, and certainly was not to be found on this side, the Government procured a number of the finest grafts by the way of Egypt and the Red Sea from Italy.—These are now introduced here and in Bengal; it proves certainly a distinct variety from any before brought to Calcutta.

The two breeds of worms sent from St. Helena by the Hon'ble Court having been established at the Residency at Soonamooky (Bengal); it appeared by comparison with the march bund Silk of Bengal to be rather inferior (specimens in proof exhibited). Hearing this I applied to Government for eggs of the Bengal march bund worm, which are now in the course of introduction in the establishments in the Deckan and at Darwar.

EXTRACT FROM THE CORRESPONDENCE FORWARDED FROM BENGAL.

St. Helena Eggs of the Italian Worm.

Extract from a letter from Mr. Colin Shakespear, Commercial Resident at Soonamooky, 2nd April 1833.

"I have the pleasure to state that, of the three papers of "the Italian eggs sent to me, a considerable portion have suc- "cessfully hatched and the Silk worms have spun white cocoons, "not so large as the Bengal annual, and with a tinge of green "owing perhaps to the change of plant on which they were fed. "Yet the small specimens of Silk obtained* as far as I can "judge evince tenacity of fibre and softness, approaching to the "silk of our annuals, which bears the closest affinity to the best

* One exhibited to the Society.

"Italian Silk. I do not for my own part," added Mr. C. Shakespear "attach any bad effect to the discoloration specified, "which indeed happens occasionally to the cocoons of these Au- "rungs. Primitive beauty of colour is certainly very attractive, "but it is presently obscured when the silk passes into the hands "of the dyer and throwster to be converted into organzine."

CULTIVATION OF THE MULBERRY AND SPECIES AND VARIETIES EMPLOYED.

A very full account of one mode of cultivating the Mulberry in Bengal may be found in a Pamphlet published in Calcutta in 1804 entitled "Remarks on the Husbandry and Internal Commerce of Bengal," as the Pamphlet is I believe scarce, I quote the account here *(in a note.)

In the course of the year 1833, I was favoured by Mr. Colin Shakespear with the following account of the Mulberry Cultivation as practised at Soonamooky. I take the liberty of abridging it as well as the remainder of the Correspondence quoted.

Note,—**To plant a new field*,—The waste land is opened with the spade in the month of April, good soil is brought and enough is thrown on the field to raise it one cubit. The ground is well broken with the plough and levelled with an implement which in form resembles a ladder but which supplies the place of a harrow. The Mulberry is planted in October; the slips are cut a span long and are thrown into a hole, and covered from the sun, they are continually watered until the end of a fortnight they begin to vegetate. They are now transplanted into the field in holes distant a span from each other and nearly a span deep; four or five cuttings are placed obliquely in each hole which is then filled up so as to cover the slips with a finger of earth closely pressed down. So soon as the plants appear in December or January the field is weeded. In April when they are grown to the height of a cubit they are topped so as to leave a stem one hand high, otherwise it is thought that the leaves would be bitter and hard and that the worms would refuse them. A hand hoeing is now given and a fortnight afterwards the leaves are ready for use. The plant is then cut down a little above the root and the silk worms are fed with the leaves. The field is weeded if necessary and another crop is ready in June and a third in July; but the leaves only of this last crop are gathered without cutting the stem, because that operation at so late a season would, it is apprehended, injure the plant. The field is again weeded and a fourth crop is ready in September.

After gathering it, the ground is ploughed four times with two ploughs and levelled with the implement above mentioned. In November a hand hoeing assists vegetation, and accelerates the best crop, which is cut in December. This is followed by hand hoeing and weeding and is succeeded by another crop in March. The same course recommences; and the field if sufficiently attended and labored, will continue to be productive during many years.

"There are two species of the Mulberry plant in the Aurungs of the Soonamooky residency, west of the Baughrubby river. The Desee or Common Indian Mulberry. The Badesee, China or Madras Mulberry, of the latter the leaves are much larger and of quicker growth than the Desee, and yet the latter greatly prevails in Cultivation. In this the leaves are closely set and more abundant in the proportion of 2½ to 1, moreover as being the most tender it is eagerly desired by the worm which thrives in proportion. It is sold by the weight or load* from 8 annas to 1 and 1½ rupee or more in adverse seasons, and is very profitable. The Indian Mulberry is not allowed to rise above a foot and a half or two feet. It is cut twice a day as required to feed the worms. The plant is thus exhausted in about the third year, and is then rooted out, but is easily renewed by cuttings and planted in rows with just enough room between them to admit of the cultivator weeding, dressing and earthing up the roots.—The ground is generally so moist at all times of the year in Bengal as to render irrigation almost unnecessary. The plant is usually cut four times in the year and stripped of its leaves, twice. The latter mode is practised in the rains only, as then from the moisture and the occasional overflow of the Ganges the cut ends of stems would generally rot."

Seeing at this period the uncertainty that prevailed regarding the names and origin of different kinds of Mulberry as well as the several modes of cultivation, I put a few queries which were sent round to Bengal together with a sketch of the Genus Morus for the remarks and corrections of Dr. Wallich and the several Commercial Residents.

The result of the inquiry is simply this, that with regard to such kinds of Mulberry as have not been cultivated for worms, the specific characters are sufficiently distinct, but that the cultivated kinds are too much changed to afford decided marks, by which either Botanists or practical men can distinguish them by description. Therefore we are still reduced to the inconvenience of naming any new kinds of Mulberry we may get, from the most important locality to which we may be able to trace them.

* Load, quantity not stated. C. S.

Extract from Dr. Wallich's Letter.

I am not acquainted with any plant of Agricultural or Commercial interest of which the natural history is involved in greater doubt and obscurity than the Mulberry. The cultivated species are scarcely to be distinguished from each other by the ordinary characters employed for the purpose in other plants. At least all attempts of the sort have proved abortive, recourse is therefere had to marks derived from the size of the tree, place of growth, colour of the fruit, and the like, all which are vague and unsatisfactory. In point of fact the real species of Mulberry are very few in number, and plants which have hitherto been considered as species are in all probability nothing but varieties, and those varieties eternally changing according to soil, climate and mode of cultivation. It is chiefly aided by the labors of Dr. Roxburgh in his valuable Flora Indica, and of Dr. Hamilton in his matchless Statistical Surveys, that I am able to offer the following sketch of the different Indian Mulberries, without however pretending to fix these as yet by any specific character or distinction.

1st. *Morus Indica* of Linnæus, the common *Toot* of Bengal. This is a native of India and undoubtedly a distinct species. There exist two varieties which may perhaps be different species, but which it is best for practical purposes to consider as varieties only. One of these varieties is never allowed to grow large, but constantly cut down to a stunted twiggy shrub, in order to induce it to produce an abundant supply of tender shoots and leaves; of all the plants that yield food for the Silk worm in India, that is by far the most important, on account of the extreme facility of its cultivation and the productiveness, luxurious juiceness of the leaves which are the favorite food of the worm. The climate of Bengal is above all others favorable to the cultivation of this shrub, owing probably to the comparative moisture, both of its soil and atmosphere, conditions which are peculiarly favorable to its growth and the absence of which is probably the leading cause of the incapacity of the peninsula to compete with our part of India in this branch of husbandry. A plantation of the *toot* will last several years, and may be renewed from cuttings with perfect ease, and

this process must be performed every 4th or 5th year if a full and sufficient crop of leaves is desired. A moderately rich light soil not too much mixed with clay, sufficiently elevated to secure the plantation from flooding either from rivers or rains, and occasional ploughing and weeding and a slight manuring constitute the chief points of attention which this sort of Mulberry demands, and if the patient and industrious Indian cultivator could only be made to prefer this method to the miserable plan usually adopted, he would reap a far more secure and ample reward from his labours than the scanty and precarious returns which he generally derives. There would be no such failures of the crops of leaves nor would such a vast proportion of worms perish annually for want of food as frequently happens to the planters and breeders.

The other variety is a tree of considerable size bearing white fruit, whereas the preceding sort has them purple. It is called *Morus alba* by Linnæus, and is perhaps a really distinct species. It is cultivated though in a trifling degree as food for the worm.

2d. *Morus atropurpurea* of Dr. Roxburgh introduced from China into this garden and now to be found in most private gardens. It is a native of that country as well as Cochin China, and is employed there as food for Silk worms. Dr. Roxburgh informs us that it has not been found to answer that purpose in Bengal. It forms a small ish tree with long straggling branches, dark foliage and deep purple large fruit.

3rd. *Morus leptostachya.* So called by me on account of its long and very slender fruit which is white and exceedingly sweet. This large tree is met with in most parts of Hindoostan to the west, where it is generally called *Shah toot.** I am not aware that the leaves are much used for rearing the worm. It is perhaps the Morus latifolia mentioned by Dr. Lush in his very able and interesting letter and also contained among the dried specimens now returned. Although I must confess my doubt as to it being Lamarck's identical tree of Bourbon.

4th. A very marked Mulberry tree with strongly serrated

* Known by this name in the Deckan, Experiments differ as to its quality as a food for the worms. It is the same that I described in my sketch as *Morus latifolia* but I now of course adopt the name given by Dr. Wallich.

leaves, and therefore called by Dr. Roxburgh *Morus Serrata*. It was found by Major General Hardwick in the Alpine regions of north Hindoostan, and the late Mr. Moorcroft sent plants of it from thence to this Garden where they thrive tolerably well, I am not aware that the leaves are used.

BOTANIC GARDEN, *Calcutta, 12th April* 1833.

Extract of a letter from Mr. J. M. de Verinne, Superintendent of the Abra Farm.

"The kinds that will grow best as standard trees, are called Morus alba of a White-berry and Morus nigra of a Black-berry with an upright large trunk dividing into two branching heads rising 20 feet high or more.

I think the common Desee the best adapted for cultivation on the Bengal plan as described by. Mr. Shakespear."

Had the Morus nigra of Linnæus existed on the other side of India, I should think Dr. Wallich would have noticed it. The above is probably a mistake. A large fruited variety of Morus *Indica* or the Morus *atropurpurea* having been thus named from having black fruit. To the best of my belief, that species of Mulberry which is naturalized in England, (the only real Morus *nigra*) does not exist in India at all.

Memorandum by Mr. W. Storm.

"There are four kinds of Mulberry used for feeding the Silk worms in the district adjoining Calcutta.

The native names are Saw, Bhore, Daisy and China. The two first produced fruits (black) but the last two have no fruit. The leaves of the Saw are very large, but they are not given to the worm till they have passed two stages. The leaf of the Bhore is small and jagged. The leaf of the Daisy is small and plain, and the China is also small and jagged at the stem. The leaves are considered equally good for feeding the worm. The Mulberry tree is not cut down for 5 years. It is then allowed to grow for five years more. It is then rooted out."

CALCUTTA, 13*th April* 1833.

Mr. Ballard's letter.

I am not aware that any experiments on the quality or description of Mulberry best suited for the worm has ever been tried in Bengal, I believe there certainly has not.

My observations, many years ago, led me to the conclusion that the occurrence of disease in the rearing houses was frequently owing to something in the food; and that the poverty in quantity as well as staple of our Silk, was materially attributable to the innutritious character of the leaves and to a *paucity* of supply.

I believe however that you cannot obtain more than conjectured replies to the enquiry.

Yours &c.

(Signed) G. BALLARD.

To GEORGE SAUNDERS and CHARLES MACKENZIE, Esquires.

Calcutta.

GENTLEMEN,

1st. I had the honour to receive your Secretary's letter No. 140, dated 21st March 1833.

2nd. The kind of Mulberry used in these Aurungs for rearing Silk worms is called the Dèsee Toot. The season for planting Mulberry is the month of *Kartick*, though I have planted it with success all the year round, the cuttings are about 5 inches long and are planted in rows about 7 inches apart. In my opinion it would be better a little further apart and in diamond shape so that viewing the Mulberry in every direction it always appears in a line, leaving passages every way for the free admission of air. The leaf of the first cuttings, of new planted Mulberry is reckoned poisonous and if given to the worms kills them, after this the plant will be fit for cutting about every two months. After each cutting the field should be weeded and dressed with a little manure; and in the month of Kartick every

year the Mulberry should be cut and the field undergo 8 or 10 ploughings and be well manured—cultivated in this way it will flourish for 7 or 8 years; after this period the ground should have a fallow or be appropriated to other less exhausting crops, for two years, when it may be planted with Mulberry again.

3rd. A hedge of Mulberry I planted last year, round my house, was cut this year on the 10th March, height 2 ft. 6 inches and 3 feet, and again cut on the 10th May, height 3 feet and 3 feet 6 inches, and it is now 2 feet and 2 ft. 6 inches high.

4th. On the 30th April 1832 I sowed some Mulberry seed which came up on the 20th May and was 1 ft. 6 inc. high and fit for cutting by the 25th August. The leaves of this Mulberry are preferred by the rearer of cocoons.

5th. The Mulberry is never permitted to grow into trees in this part of the country though I have tried it and it will grow into a tree upwards of 10 or 12 feet high, but the wood is liable to be attacked with worms and the trees soon decay. I should consider this mode of cultivating Mulberry very expensive and ruinous to the chasas.

6th. When the Silk worm is first hatched it feeds on young Mulberry leaves, and as it grows, stronger leaves of an older growth are given it to feed on.

I have the honor &c.

(Sigd.) R. RICHARDSON,

Resident.

Commercolly Factory, the 20th June 1833.

To G. SAUNDERS, Esq.

Acting President and Members of the Board of Trade.

Fort William.

GENTLEMEN.

I have to acknowledge the receipt of Mr. Secretary Macnaghten's letter of the 21st March last, No. 138, and its enclosures

from the Bombay Government, requiring certain information regarding the Mulberry reared in these Aurungs as food from the Silk worm.

2nd. In the Bauleah Aurungs the Mulberry cultivation is entirely accomplished by cuttings of five or six inches in length, and in the course of five or six months after plantation, they become sufficiently rooted in the ground to admit of the shrub being cut, as food for the worm. The cuttings are set three or four together with six inches space between each cluster, and in rows, leaving sufficient width between the rows to admit of the ground being turned up by the khodalee and the small plough used in Bengal.

3rd. The Mulberry fields are never irrigated ; but if the weather be favourable with a seasonable supply of rain five or six crops may be obtained throughout the year but never fewer than four, unless the season be unusually droughty.—If the Mulberry fields be originally planted on good land, well attended and kept well weeded, the plant will last ten or fifteen years, in this case, it is necessary to supply fresh earth annually, as manure, after the first two or three years. The time however which one set of cuttings will produce the leaf with nutrition depends much upon the quality of the soil and the attention paid to render it fertile ; some fields will not last more than four or five years. The plant or shrub is used when it has obtained its proper growth according to the season and whilst the leaf is fresh and nutritious. The height to which it grows before it is cut, varies as the weather may be favourable or otherwise, it may be stated from two to four feet. The plant required is cut three or four inches from the ground excepting the rainy season when the stumps are allowed to be eight or ten inches in length.

4th. After the plant has been used for the worm in July, it is allowed to grow to waste, in order that the rains or inundations may not destroy or injure it. The rains having subsided, the plant is cut down, the land ploughed and dressed as may be requisite for the grand Bund of the year, called the "November," but the worm (composed of the Désee description) does not come

to maturity before the end of December and the beginning of January.

5th. The next Bund which is called the "March Bund" rears both the annual and Desee cocoon as may be taken up by the villagers. The annual worm on the Bauleah side of the Ganges has not been so extensively matured as on the island of Cossimbazar, the Radnagore and Hurripaul Aurungs, indeed it is only three or four years since this description of worm has been cultivated by the ryots of the Bauleah Aurungs.

6th. At the time called by the natives "Sree Punchomy" about the end of January the annual worms begin to disentangle themselves from the shell, and in a few days thereafter, if the egg does not hatch the worm of subsequent date seldom thrives or comes to maturity with advantage.

7th. The two following Bunds called the "April" and the "June, July" Bunds are generally composed of the Nistry or Madrassee worm, which is better able to withstand the rainy and sultry weather experienced as the sun approaches and leaves.

8th. In the Bauleah Aurung not a worm is reared from the leaf of the tree. But the large or annual cocoon worm prefer the leaf of the shrub which is well matured to that which is young and tender. Hence it is inferable, that the annual worm would thrive better with the tree leaf than the shrub leaf. The tree altho' never used in this district, is said to be cultivated in parts of the Rungpore and Radnagore districts for the production of cocoons.

9th. The Mulberry shrub notwithstanding it occasions more labor and expense, is more profitable than the tree from its yielding four or five crops in the year, and thereby is more suited to the Dèsee and Nistry worm—whether these descriptions of worm would thrive on the leaf produced from the tree I am unable to say.

10th. Not being sufficiently acquainted with Botany, I am quite unable to afford any correct information as to the description of plants grown in these Aurungs, but probably both the white and red kind are used. I beg to forward herewith two descriptions of leaf from plants cultured in these districts, but the natives have

no names to distinguish them, if they should belong to different classes. I beg also to forward eighteen fresh Mulberry cuttings, they are somewhat longer than they should be for planting, but this has been allowed purposely to admit of an inch at each end being cut off, before they are put into the ground, to induce vegetation.

11th. It is perhaps worthy of remark that Mulberry plantations are not cultivated out of the province of Bengal. The cause, from which this happens, is said to be, that neither the soil nor climate is congenial to the growth of the plant. The land of Bengal, indeed is only partially adapted to its culture and spots of ground are selected accordingly-

I have the honor to be &c.

(Signed) C. C. HYDE,

Resident.

Bauleah Residency,
the 30th June 1833.

Extract from Mr. Colin Shakespear's Letter.

1st. Query by Dr. Lush.

What kinds of Mulberry do the Worms prefer?

Answer.

Decidedly the indigenous (Dassee or Kajlah) cut plant. The leaves being closely set, and more abundant in the proportion of two and a half to one, as explained in the 6th para. of my letter of the 27th October 1832, and remark annexed thereto. It is the "Morus alba" or white mulberry not allowed to fruit.

2nd. What kinds will grow best as standard trees and what are the best adapted for the field cultivation in the Bengal plan?

Answer.

Worms fed on the standard (Sâtee BaDâsee or Foreign) do not thrive. It is therefore only cultivated for fruit and that sparingly. It arrives at maturity or fruit-bearing in about three years. It is the "Morus rubra' or red Mulberry

approaching to black, a poor fruit about an inch long, cylindrical, bears twice in the year about October and March.

Remarks.—The cut plant flourishes in the low lands about Rangumattie when the soil is sandy, which keeps the root cool, and irrigation is not so necessary or indeed used here, as it quickly looses itself in the sand ; but in the high tenacious loamy soil where water will pass over the surface quickly, irrigation is had recourse to, and a more abundant crop is produced, consequently encouraged by the planter to his own profit. But too much watery matter tho' eaten voraciously by the insect is hurtful from its comparative want of nourishment, or solid nutritive matter, as already observed (7th para :) The nature of the plant itself being sufficiently succulent without artificial means, a rich soil is by no means so proper as that with an admixture of sand above specified.

11th Dr. Lush further desires information from Bengal on the following points :—

1st. Has the Italian plan now following at Poonah of setting cuttings from the standard 8 to 12 ft. apart to be trained up as standard trees the leaves of which it is proposed not to gather for four years been tried in Bengal ? and if it has,—with what success ?

Answer to 1st.

Not in the Aurungs of the Soonamooky Residency which includes Gonatia the general name of all Silk manufactured therein, I cannot speak of others, tho' I have never heard that such practice obtains elsewhere.

2nd. Will the leaves be improved or otherwise as food for the worms in this climate by being produced from old trees ?

Answer to 2nd.

The established practice already fully explained seems to prove the contrary.

3rd. Provided the trees and the leaves be improved by age and produce a larger crop as they grow older, still will it be possible with any supposable rate of profit to compensate for the capital of a

3rd. Answered with reference to the 1st and 2nd queries (10th para : of this) I think I may safely add that certain disappointment and loss of capital *would attend* such speculation, contrary to the

Silk Farm lying dead for four years, in a country where labour is dearer than in Bengal, and irrigation necessary.

existing nature things in these Aurungs. But Dr. Wallich may give a different opinion as applicable to other soils and districts.

12th. I have the pleasure to state that besides having obtained a few small specimens of Silk from the newly *imported* worms hatched here, I have secured a considerable quantity of eggs supposed to be annuals wherewith to propagate the breed during the next periodical season of hatching them. By which period it may reasonably be expected that plants of the "Doppia Foglia" may be in readiness to feed them. The experiment on this side of India in these Aurungs will then be complete and general dissemination follow. But perhaps it may be anticipated in Calcutta.

13th. The practice and prejudices of the Hindoo Breeder of the Silk worm in these districts may not be uninteresting. They pretend to hold the Insect in a degree of religious awe, and thus as sacred, impose on themselves penances for its salvation, handed down from one generation to another, through time immemorial, which are strictly abided by in the progress of feeding the worms, more especially during the critical periods of the four ages or sickness, while moulting during which the worm has reached two thirds of its full growth and until it ultimately encloses itself in its pod. Men do not shave or perform their ablutions or oil their bodies, but remain clad in their dirty clothes. Fish, Turmeric, Garlick, Onions, Snuff, and tobacco are prohibited, tho' they smoke outside their houses. Surely the proscribed have the best of it. To crown the whole conjuration, as a charm against evil spirits, an old shoe with a bundle of thorns is hung up on the check (lattice skreen) at the door of the breeding house.

I have the honor, &c.,
(Signed) COLIN SHAKESPEAR,
Resident.

Soonamooky Residency,
Rangamatty, 2d April 1833.

Note.—In Italy and France the breeders are particular in keeping their hands and clothes free from the taint of Tobacco, Snuff, Garlic, Onions and Oil, as being all dangerous poison to the worms; precautions which the witty Hindoo perverts to mysterious prohibition and the exclusion of others not initiated in the sanctity of his rights.

Letter from Mr. J. W. Grant, Resident at Hurripaul.

In reply to your letter No. 139, dated the 21st ultimo, I have the honor of informing the Board, that there are two varieties of the Mulberry here, one of which, the Dasee, is generally cultivated for feeding Silk worms, the other called simply by the natives the large Mulberry, bears a purple fruit and is cultivated in Gardens.

2nd. Although the large Mulberry yields more leaves, the Dasee is preferred as agreeing best with the Silk worms. It appears that those fed with the garden Mulberry yield an inferior cocoon.

3rd. I send specimens of the leaves of each for inspection, the Dasee I believe gives a white berry, but it is not allowed to produce fruit.

4th. The method of cultivation differs from that in use about Bauleah and Mulda, the leaves only being here gathered from standards.

5th. Slips are planted in October and leaves are gathered from the plants in the following June. Between three and four years from the first gathering of the leaves the plants are cut down close to the ground, this is done in February and leaves are again plucked from the new sprouts in the following June.

6th. In good soil the trees last upwards of fifteen years, and in bad not less than six or seven, but whatever may be the time a tree lasts, it is a rule to cut it down close with ground every three years so as to keep the standard of a height which enables a man to pluck the leaves without climbing.

7th. The earth is dug up and the trees manured in October and at this time they are also watered, fresh earth is put around them in February and they are watered two or three times more during the year according to circumstances. Wherever grubs appear the earth is dug up to destroy them.

8th. The reason given by the natives for preferring the standard trees to cultivating in the same way as at Bauleah is that the soil is too dry here to answer in any other way than with standards.

I am, &c.

Hurripaul Residency, the 5th April, 1833.

(Signed) J. W. GRANT, *Resident.*

Mr. Lane ascertained that the Gonatea cocoons yield a stronger Silk than the Hurripaul, I am unable to say if this is owing to climate or to the superior quality of the Mulberry. Mr. Shakespear states that the plant is dug up and thrown away about the third year, this is not the case about Bauleah, as far as I recollect it is not quite exhausted there under nineteen or twenty years.

Soonamookey Residency, Bengal, 1831.

Particulars of the produce of Cocoon Bunds throughout the year in the Gonatéa and Rangamattee Silk Aurungs, West of the Banghurtty River, shewing the cost per seer in each Bund, and produce in Silk of different assortments.

1830. *October* (or Khartick) *November* (or Urgwhyenee) *January* (or Poos) 1831.

From the hatching of the egg in these bunds to the completion of the cocoon pod 40 to 60 days, may be taken as the average.

Price 2 Khwans per Rupee more or less 16 dollahs produce one Gurrah or 48 Khwans of cocoons, requiring 14 loads (or bundles) of Mulberry leaves at 1 Rupee each. Rs. 14 0 0
Price of Eggs ... ... „ 1 0 0
Putwah, or Breeder. ... ... „ 3 0 0

Total Rs. 18 0 0

Fixed Price, 1831.

The 48 Khwans yielding 2 seers 12 chettocks of Silk, of No. 1 and 2, A. 4 to 5—7 to 8... Rs. 8 8 0
Average Khwans per seer 17 to 18—18 to 19 medium of premium, or garbling of cocoons for the fine assortments. 0 7 4

Per seer, Rupees. 8 15 4

March (or Choyte) Bund large annual cocoons from the Eggs produced in 55 days to 60 days. 1 khwan 10 poons per rupee,

16 dullahs, or one gunah of 24 khwans requiring 14 bundles of leaves at 1 Rupee each... ... ...Rs. 14 0 0
Price of eggs. 0 4 0
Putwah or Breeder. 3 0 0

Total Rupees. 17 4 0

The 24 khwans yielding 2 seers 4 chettocks of Silk, Nos. 1 and 2, A. 4 to 5—7 to 8 Rupees.... 8 8 0
Average khwan per seer 13 to 15—23 to 24 Medium of premium, on garbling of cocoons for the fine assortments. 0 7 4

Per seer, Rupees. 8 15 4

March, small cocoons from the eggs are completed in 50 to 60 days, price 3 khwans 4 poons per Rupee, 16 dullahs or one gunah of 45 khwans requiring 13 bundles of leaves at 1 bundle per rupee ... ... Rs. 8 8 0
Price of eggs..... ... ... 1 0 0
Putwah or Breeder... ... ... 3 0 0

Total Rs. 12 8 0

The 45 khwans, yielding 2 seers 2 chettocks of silk No. 1. B. 1 C. of 10 to 12—18 to 20 ... ... Fixed Price. Rs. 7 0 0
Average of khwan per seer 16 to 17 No Premium.

April (or Bysack) cocoons from the eggs are completed in 30 to 32 days, Price 3 khwans 8 poons per rupee, 16 dullahs or one gunah of 32 khwans requiring 11 bundles of the leaves at 1—2 bundle per rupee ... ... Rs. 7 6 0
Price of eggs 0 8 0
Putwah or Breeder 2 8 0

Total Rs. 10 6 0

The 32 khwans, yielding 1 seer 10 chettocks of Silk No. 2 B. C. 2—12 to 14—20 to 22	Fixed Price. Rs. 7 0 0
Average of khwans per seer 16—17.	No Premium.

July (or Srabun) cocoons from the eggs are completed in 28 to 30 days, price per khwan 3 to 3½ per rupee, 16 dullahs or one gunah of 32 khwans, requiring 12 bundles of the leaves at 2 bundles per rupee ... ... Rs. 6 0 0

Price of eggs	„	0 8 0
Putwah or Breeder	„	2 8 0
Total	Rs.	9 0 0

The 32 khwans, yielding 1 seer 8 chettocks of Silk No. 2 C. No. 1—18 to 20—20 to 22	Fixed Price. Rs. 6 12 0
Average khwan per seer 28 to 31.	No Premium.

Thus 181 khwans of cocoons producing 10 seer 6 chettocks at the cost of ... ... Rs. 67 0 0

Gives the general average cost of cocoons at Rs. 6 8 per seer, which in 1836 was 10 2 0

Difference Rs ... ... 3 10 in 1831.

Recapitulation of the price of the Bunds.

1	Bunds October. November.	16 Dullahs 1 Gunah or 48 khwans of	Yield 2s. 4c. of Silk No. 1 & 2, A. sizes 4 to 5—7 to 8 Average per khwan per seer 17 to 18—18 to 19. Fixed price 1831 ...Rs. 8 8 0
1	January.	cocoons.	Medium of premium on garbling for fine assortments--0 7 4
			Rs. 8 15 4
1	March	24 Do. Do.	yield 2s. 4c. of Silk No. 1 and 2, A. size 4 to 5—7 to 8. Average khwans per seer 13 to 15—23 to 24.
	"		
	Large		

				Fixed price 1831, Rs.	8	8	0	
				Medium of premium for fine assortments	0	7	4	
				Rupees	8	15	4	
1	March Small	45	Do. Do.	Yield 2s. 2c. of Silk No. 1 B. C. 1 of sizes 10 to 12—12 to 14. Fixed price Rs. 7. No premium. Average per seer—16 to 17				
1	April	32	Do. Do.	Yield 1s. 10c. of Silk No. 1 2 B. 2 C. of sizes 10 to 12—12 to 14. Fixed Price Rs. 7. No premium. Average per seer 16 to 17				
1	July	32	Do. Do.	Yield 1s. 8c. of Silk, No. 1 2 C. of size 18 to 20. Fixed Price 1831, 6 12 0. No premium				
6	Bunds			Average per seer 28 to 31.				

181 Khwans of cocoons. Average cost of cocoons per seer ... ... Rs. 6 8 0

Do. Do. of silk per seer at the fixed rates of 1831 of ... ...Rs. 7 8 9

General Average per seer 10 to 12 to 30 and upwards: about 45 Begahs yield a maund of Silk or one Begah and a portion to a seer.

The Nirick of the high lands (or Peteat) vary per Begah* from 3 to 5 Rupees.

Do. Do. of low lands (or Beraty) from 1—4 to 3 Rs.

The plant yields five or six crops in the year throughout, but the price per load fluctuates, even so much as from Eight annas to two Rupees (and upwards in adverse seasons). The medium is therefore taken of one Rupee per load.

* About 1-3rd of an Acre.

The charges for cultivating one Begah of Mulberry land is under ten Rupees per Annum including Rent, viz.

Average Revenue, or Rent per Begah... ...Rs.	4	4	0
Manure (Saure)...	1	8	0
Labor of 40 days in the year...	4	0	0
Total Rupees	9	12	0

Which Begah is calculated on the average to produce

14 loads at 1 Rupee each... ....Rs.	14	0	0
Gain...	4	4	0

But supposing only 44 bundles are obtained in the year from one Begah the produce will be Rupees. 44 0 0

Deduct charges of cultivation and rearing as above. 9 12 0

Profit, Rupees. 34 4 0 per annum.

(Signed) COLIN SHAKESPEAR,
Resident.

(True Copy)
COLIN SHAKESPEAR,
Resident.

Soonamooky Silk Residency, 11*th April,* 1831.

MEMORANDUM.

4 Cowries 1 Gundah,
20 Do. 1 Poon,
16 Poons 1 Khwan, or 1280 Cowries,
16 Dâllahs (of 3 Khwans each) makes
One Gurrah of 48 Khwans { Requiring from 11 to 14 loads or bundles, of leaves.

The "Dâllah" is a round Tray of Mat, about 5 feet diameter, on which the worms are fed with Mulberry leaves and when about to spin their cocoons are removed to an oblong Mat frame, about the same dimension, called "Chunder-Key" on which there is a spiral

lattice frame about 2½ inches high forming compartments wherein the worms spin its cocoons.

Of the samples of Silk laid before the Society valuations have been made at Poona, Ahmednuggur and Bombay, from which it appears that the Silk now produced by Mr. A. Graham and by Sorabjee Patel, reeled by the China reel is precisely adapted to the consumption of the country. If the article be made finer it will not, for native manufactures, fetch a higher price. If finer Silk is reeled it must be sent to Bombay for exportation. These Poona and Ahmednuggur samples are classed in Bombay with the China Silk called *Taysaam* which sells at 12½ and 13 rupees the pucka seer (2 lbs).

Thus from Mulberries planted in all manner of ways with the sorts mixed and by the simple Chinese reel, one great step has at least been made *to produce that which will sell the best at the nearest market.*

If we expect to see the production of Silk extend among the natives we should at first propose the use of the Chinese reel only. It is worked by one man. The Italian reel requires three; one at the basin, one to turn the handle or winch, and one to keep up the fire. The Chinese reel requires a very small quantity of fuel, another *Deckan* argument in its favour. The Italian reel in return for the labour of three persons and the larger expense of fuel, reels double the quantity of Silk in a given time. Italian reeling would require an extensive factory, and its machinery is not portable. Any reeler may carry about the Chinese apparatus and work it where he pleases.

I need not enlarge upon the extensive market there is in India for course raw Silk. I will just allude to the article of *Spun Silk* (specimen exhibited which is made from the damaged cocoons,)—those which are deformed, abortive, or have been perforated by the moth. These in Mr. Graham's establishment are turned to good account. They are spun into a coarse thread, after being soaked for a night with some Lentil seed. They are pulled out and twisted around a bamboo skewer exactly as twine is made in this place for fishing nets.

This spun Silk brings 6 rupees the pucka seer at present, and when made a little finer it is expected to sell at 8 rupees.

I shall now conclude with a few directions for combining the Bengal and Italian methods of planting the Mulberry, so as to form the most economical plantation for the circumstances in which we are placed on this side of India, where irrigation is absolutely necessary.

The variety of Mulberry termed "St. Helena" is the quickest in growth of any of those brought to this country which are adapted to tree cultivation. This may be seen by any one who will take the trouble to visit the Kutoor Bagh, where in good soil, and under the hands of Mr. Mutti some of this kind have made an astonishing growth.

These when planted at 12 feet distance reserving a four feet bed around each tree, will take up one third of the field, and in three years (perhaps earlier in rich old garden ground like Kutoor) they will be fit for use. There remain two thirds of the field to be disposed of. These two thirds should be planted with the common Mulberry, the Desee Toot of Bengal which will yield a crop within six months, and according to the system described by Mr. Shakespear, after giving four crops a year, being continually cut *and never allowed to rise above* 1½ *(one and half) foot in height,* will in three years be exhausted. They will then be dug up, and the field thenceforward appropriated solely to the trees, unless some small annual crop be insinuated between them in order to assist in paying the expenses. In proposing to persevere in the use of the Bengal Desee Toot for a crop, I may shew as a proof, that this variety does not necessarily produce a coarse Silk, some specimens of the March Bund Silk of Bengal reeled at Soonamooky. The worms producing this having been fed on this kind as described by Mr. C. Shakespear. Whether we shall ever be able even with improved food to exceed this on our side of India I cannot pretend to foresee, but I humbly submit that our present object ought to be *to extend among the natives of this country a process that they are the most capable of carrying on and the produce of which is the best fitted for their own home market.*

BOMBAY, *5th January,* 1835.

APPENDIX.

Sketch of the species and varieties of the Genus Morus cultivated for feeding Silk worms.

[N. B. This was sent to Bengal for remark and correction, and is inserted here for the same purpose. Dr. Wallich's remarks are a sufficient apology for its imperfections.]

I. § Fruit roundish.

Morus nigra.—The common officinal Black Mulberry, not in India, used in some parts of Europe and in Persia (?) for feeding worms.

II. § Fruit Cylindrical, (a) *fruit very long.*

Morus leptostachya [Wallich.] The Shah Toot, leaves rough, variously divided or entire.

A large Tree.

(b.) *Fruit short.*

Morus Indica,—Leaves entire or divided, smooth heart-shaped, equal at the base, fruit deep purple.

Varieties.

* Stem shrubby and diffuse, leaves divided.

1 Désee Toot of Bengal.

2 Badèsee,—Madrassee or China, cultivated by Mr. A. Graham at Ahmednuggur and by the Engineer Corps at Seroor for Gabions.

** Stem arborescent, leaves never divided.

1 "St. Helena Mulberry" sent from that Island by the Honorable Court of Directors, the best kind for tree cultivation.

Query. What is *Morus Tatarica?* Is it the last mentioned? Vide Sprengel Sys. Veget. Vol. III.

Morus Alba—Leaves entire or divided, smooth heartshaped; unequal at the base—fruit white or variously colored, pink or purple.

VARIETIES.

* Arborescent.

1 Italian White fruited Mulberry introduced here from Italy, brought viâ the Red Sea by the Hugh Lindsay Steamer.

2 "*Doppia foglia,*" an Italian variety, sent here from St. Helena.

** Shrubby and diffuse.

1 Red fruited variety from St. Helena. large entire leaves, red, very acid fruit without a Mulberry flavour.

*** Doubtful varieties.

A large leaved variety—*query,* Rose—leaved or Spanish Mulberry? has not yet yielded fruit, came in the same boxes with the white variety by the Hugh Lindsay.

A Mulberry, raised from seed procured from Kabool by W. H. Wathen, Esq. Chief Secretary to Government.

The above, with Morus *Mauritiana,* and Morus *scandens,* both received from Bengal but never used as far I know for feeding worms, are all the kinds cultivated in the Garden at Dapooree, where the real Black Mulberry is of course still a desideratum.

Note.—To procure clean straight growing young Mulberry trees, the following method, which is in use in some parts of Bengal I have found to answer better than any other: after having tried cuttings of all lengths and sizes. Take cuttings of wood of only a year old, a span only in length, when the leaves are off and new buds are formed, bury them in the ground and water freely. in about a month or as soon as roots have well struck, transplant them singly, and in a year they will be ready for finally planting out.

To JOHN BELL, Esquire,

Secretary to the Agricultural Society of India.

Calcutta.

Sir,

I have the honor to enclose herewith a few remarks on the culture of the Silk in Bengal, which I shall feel obliged by your laying before the Agricultural and Horticultural Society.

I have been informed that the society wished to have a treatise on this subject, but as such from me would only have been a

repetition of what I have published in my "Guide," a copy of which has been presented to the society, it appeared to me that the enclosed paper in conjunction with my "Guide" would probably be found useful.

I shall at all times feel happy in giving to the society any urther information on the subject, and it will be a pleasure to me if I succeed in convincing the society of the great advantage that would result in cultivating the Mulberry as a standard Tree, instead of the Bush, by which means I feel certain the quality of the Bengal Silk would be materially improved.

I have the honor to be,

SIR,

Your most obedient Servant,

G. MUTTI.

BOMBAY,
20th October 1838

(True Copy.)
G. MUTTI.

In remarking on the culture of Silk in Bengal I must first state,

That I have twice seen cocoons produced in Bengal which were of a small size and soft, but which having been sent here as samples, I suppose were the best that could be procured.

From the manner that I have seen two Bengallies here rear the worms and wind Silk, who were expressly selected and sent for the purpose of teaching the whole of the silk process inclusive of the mulberry cultivation.

From enquiries made from them.

From information derived by me by perusing the several Bengal accounts in the Newspapers and elsewhere.

From the Report lately published of the proceedings of the E. I. Company in the cultivation of Silk, &c.

From my careful xamination of some of the best Bengal Silks.

And finally from comparing the whole with my own experience in Italy and here, I perceive three principal faults in the Bengal Silk culture, viz.

1st. The system of training the mulberry as a bush or shrub.

2nd. In the rearing of the Silk worm.

3rd. In the reeling of the Silk.

And I would respectfully remark,

That in Bengal several prejudiced opinions exist regarding the method of training the mulberry as a standard, viz.

1st It is said that by feeding the worm with the leaf of the Tree, the Silk becomes coarse.

This is plainly contradicted by the fact that in Italy where the finest silk in the world is made, the worms are fed only with the standard leaf.

I myself here find that by following the same Italian plan, I get the best cocoons and finer silk.

2nd. It is said that the leaf of the tree being hard, the worms do not eat it.

This clearly shews that as the worms are not properly reared they become weak, and therefore have not strength enough to subsist upon hard leaves.

In Italy not only are the worms fed with the leaf of the Tree but we make there also a difference and distinction in the leaves paying more for those of an older tree and hard ones, and it is also to be borne in mind that in this climate, this insect for a part of the year ought to be more healthy and stronger than there, where only by artificial means and precautions, we are able to keep it up.

3rd. It is said that the standard mulberry does not succeed in Bengal it having been tried but without success.

The very same thing was said here some years ago regarding the Concan and Deckan, but experience has now proved the contrary.

It was just for the sake of removing the prejudice which ex-

cited on the subject, that I undertook to train 14 varieties of mulberries as standards, among which there were several of very bad descriptions and Bushy including the China divided leaf and every one has astonishingly succeeded, fine standard Trees, with large stems, branches, &e.

The only inconvenience I had was that they gave me great deal more to do than the other good species.

They succeeded not only in the Deckan but in Bombay and Salsette, where the climate in some places is approaching to that of Bengal, but with this disadvantage, that it is not so moist and damp as in Bengal, which is a very grand thing.

4th. It is said that with the bush system, silk can be made 5 and 6 times a year, whereas with the tree only 3 or 4.

True it is, but it is also a fact, that

1st. The result of the worms fed with the bush leaf will not produce as much as that fed with the standard leaf.

2nd. With the bush system a person is engaged all the year round in rearing worms and winding Silk, and after all does not make so much silk as the other who uses the tree.

3rd. The bush occupies a great extent of land and gives fewer leaves as compared with the tree.

4th. The leaf of the bush has little substance and cannot be expected, nor is it possible to produce as good cocoons as from worms fed with the leaf of the tree.

5th. The bush requires for ever expence and trouble, which is not the case with the tree, as after a few years nothing is required for the latter except pruning and thinning, which labor is amply repaid by the wood obtained, and this certainly is a very great object, saving money and labor.

6th. For the proprietor of the land having standards in his ground the place is a valuable one, it is actually a capital that he has got, and the income which he yearly derives from such estate is far superior than if it is planted with bush.

But what is also a very great object, is that with the leaf of the tree, if the worms are properly reared, we may always have splendid Cocoons,—which not only is a great advantage from the greater quantity of silk that would result, but also that we may easily have fine even and clean Silk, and it is quite a mistake to expect to have perfect Silk from bad Cocoons, and notwithstanding the ability of the workman, the work is tedious and the result unsatisfactory. Let an experiment be made of one Begah or one hundred plants of the St. Helena species following my directions given in the guide to the Silk Culture regarding the planting and rearing the standard, and I have no hesitation to say that the result will be, that not the bush, but the standard tree system will be found to be the one that should be followed even in Bengal.

If the same extent of land now occupied with bushes were substituted with standards, a very much greater quantity of Silk would be obtained and more easily would result of better quality, besides the other advantages I have already mentioned, and in conclusion I doubt not that the cultivators of the mulberry, the proprietors of the Land, these rearing Silk worms and winding Silk, they will be a great deal more satisfied.

2nd. The rearing of the Silk worm.

This insect is not properly reared and consequently the cocoons produced are poor, the worm requires a longer time to spin, and the consumption of leaves is greater.

One of the worst and most prejudicial things is, that the worms are kept too crowded in the baskets some times owing to carelessness or bad instructions and at others to one of those *mal entendaes* speculations to save leaves. In fact the 2 Bengallies and others observed to me on my making this remark, that by keeping the worms in less baskets there is an economy on the consumption of leaves.

I agree in that, for notwithstanding all the attention that could be paid (and indeed it cannot be expected that every one will be zealously attentive), the consumption will be always greater and there will actually be some waste of leaves.

But this loss for the quantity required to make one pucka seer of silk will amount let us say to about 20 pucka seers of leaves more. This decidedly cannot at all be compared with the greater loss that would arise from the cocoons produced not being so good as when the worms are kept, not crowded as say about 15,000 of the former would be required to give the same product of Silk, for which about 10,000 of the latter would be sufficient.

It is likewise certain and evident that the insects will not all spin in 2 and 3 days—a part will remain a longer time. What greater quantity of leaves would then be consumed? Consequently the assumed loss of about 20 pucka seers of leaves is only an imaginary one, and instead of a loss there is actually a saving of leaves also.

It is very easy to correct and put a stop to this very great inconvenience, by taking the trouble to show and look after the people rearing the worms for a few days until they get the habit.

There is also another fault which is too remarkable, no difference is made in the leaves that are given to the worms, especially in the last stage.

No care is taken to preserve properly the leaves for the night, that they may not get dry or ferment. Let a certain number of worms be reared by removing them every 4 days, not keeping them crowded, and choosing the leaves to be given according to their age, care to be taken of preserving the leaves and I am bold to say, that a remarkable improvement will be the result.

Here, several times I made those experiments and astonished the people by showing the great difference that results if the Worm is reared *comme il faut*.

3rd. Reeling of the Silk.

It is a thing that very much astonished me to observe a great quality of Bengal silk to be so dirty and in so neglected a state.

To clear the silk of Neebs and uneven threads and *fili matti* is an easy operation.

I have got besides the men, several lads that are doing it perfectly well and they had but little practice. It only requires some practice and patience and not to be in a hurry.

It is a prejudice that generally exists in India to suppose that all the Natives are good for nothing, and it is absolutely necessary that they should be constantly superintended by an European.

My experience shews the contrary. But it may be permitted me to observe that to succeed in getting a good one we should not follow the system generally adopted, which is to order a thing and to be off leaving the man to go through it, or rather to say leaving in a mess.

It requires some patience to stay with him, put him in the way and assist him, and finally from time to time, to reward him with some presents for his exertions. No such things are observed here, and as to presents it is said to be an extravagance adding "the man has got his (or good) pay."

I ascribe to nothing more than to some patience and presents, my having been able to muster several clever and very active Natives among my people.

BOMBAY,
20th October, 1838. G. MUTTI.

(True Copy)

G. MUTTI.

EXTRACT

Of a Report from Mr. Mutti, Superintendent of the Silk Culture, dated 15th July 1839, *to the Acting Collector of Poona.*

14. Of the Plantations made, several are entirely lost, principally for want of irrigation; almost all the Streams, Rivers and many Wells having dried up; the famed Narrangaom Bund did not run for some time—some Plantations have been destroyed by Cattle, some rooted up for fear, and finally others left to perish by the Cultivators.

15. Notwithstanding all these disadvantages and obstacles after

giving to them full consideration, there remains a greater number* of Plantations in existence than could have been expected, while it was the opinion of many that not a Plant would exist—almost all our losses have been of Mulberry Hedges and Nurseries, but we have had in return Plantations of a quantity of Standards, besides a number of the Hedges are still in a flourishing condition; almost all the young Trees are planted in the centre of the Land, and the Cultivators are much pleased, and seem to take great care of them.

16. We had the satisfaction of assisting other quarters of this Presidency, and of India generally, with Mulberry Seed, Seed Plants, Silk-worm Eggs, and also with informations. The experiments through this assistance have been attended with favorable results. From the state of incertitude of the present temporary establishment for the production of Silk, and the want of some fixed and settled locality, and for other reasons, I have suggested to my Assistant, Setwa Goondgall, to establish a Silk Manufactory at Wargaom Kassimbeck, at page fol. 7 will be found an account of its first successful attempt. There will be found also at page fol. 12, a Report of several experiments &c. in Mr. F. de Ramos' estate at Naigao, near Bombay. Finally at page fol. 9 and 10 will be found several informations regarding the Silk Culture proceedings and progress.

17. It will be seen, that far from having been too sanguine in my expectations from the Silk Culture, the result has on the contrary been beyond them; in fact, in my Guide I stated that in the hot weather the progress of the Worms is but slow; that they take a longer time to spin, and they do not then form good Cocoons, and unless great precautions are taken the great heat il l the Worms.

18. The weight of my best Sulphur and Yellow Cocoons, 5 days after the Worms had begun to spin, and before being baked, had been, for 5,000 Cocoons, Pucka Seers (of 80 Rs. each) 5 to 5⅛ and this has been the case during several years, and the Cocoons

* I shall shortly make a general inspection and send in my Report of what remains of the former Plantations.

spun in the most favorable season. The Eggs of the Worms forming White Cocoons hatched irregularly, and the Cocoons obtained, were not large.

19. In my estimated return (vide Appendix page 10) I calculated 18,000 Cocoons would be required in the hot season to make one Pucka Seer of Silk. That on the first year of the plantation, of one St. Helena Mulberry Tree could be got 4 Seers of Leaves in pruning it. I do not doubt that the Natives would be easily induced to devote their attention entirely to the cultivation of the Mulberry Tree, in preference to the Fruit Trees—all the operations connected with the making of Silk are well adapted to the Natives of this country; they suit the aged as well as the strong and healthy constitutions; the Females as well as Men; and I feel quite satisfied, that to make improvements in this country does not require Lacks of Rupees, but that as in the instance of the Silk Manufacture, the Natives now begin to appreciate, though as yet slightly, its advantages; and that, with the encouragement, protection, and some assistance at first from Government, such soon would form a rich and important article of sale, add to the Revenues of Government, and diffuse wealth and comfort among thousands of its now impoverished subjects.

DECKAN.

RAW SILK MANUFACTORY established at Wargaom Kassimbeck, 2 miles distant from Manshire, and 8 miles from Narrangaom.

20. I suggested the formation of this Establishment to my Assistant Setwa Goondgall, for many local reasons, which it is unnecessary here to state, but chiefly to give the Natives in the neighbouring Villages confidence that the Trees they were planting would yield them a return; by thus shewing to them the use to which these would be put to, and to give them some idea of the value of them. For otherwise, it is contrary to my plans to start such an Establishment until a supply of Leaves and other requisites are first of all secured; and it has not been without some regret, I

felt induced, by peculiar circumstances, to suggest the premature formation of this Establishment. The first attempt to make Silk here, in May last, has however been very satisfactory.

21. About 35,000 "Mutti's Worms" have been reared. The Eggs were hatched in April, and the Worms spun in May, not one died; they were of a large size, and as healthy as in their favourable season of the monsoon; while in fact, also they were fed during the last days of their stage on the "Shah Toot" the leaf of which is large, hard, and harsh.

22. The Leaves were besides brought from a distance of 12 miles in the hot burning weather of that month, and these also were given to the Worms not in the same day, but on the second and third day, after having been gathered.

23. I had chosen and weighed some of the Cocoons produced, and before baking found them to weigh

13	to	1	Tolla.
100	to	7¼	ditto.
200	to	12½	ditto.
500	to	33¼	ditto.

of White, Yellow and Sulphur colour, without any difference in their quality.

24. To wind the Silk, which was of various qualities, to shew what could be done by them, Natives were employed from Poona, Wargaom, Cheenchoree, Goonjoorwaree and Joonier, and the Silk was sent to Bombay for inspection, and the most satisfactory Reports of its quality had been received.

25. Doctor Gordon's "Ambala" monthly and yearly Worms formed very small Yellow Cocoons, but with almost no floss; they hatched irregularly, a few in a day, and the Worms in their full growth were very small; we shall see what improvement they may make hereafter; but I do not think much of this breed.

26. If no intrigue or obstructions are allowed to interfere, without doubt this infant Establishment, the first foundation of the extensive plan I had in view, cannot fail to progress. Setwa Goondgall has all the qualifications and merits required, and is indeed a

very superior Man, my best one, and is well acquainted with every process connected with the Silk Produce. He is also very zealous, energetic, of an excellent temper, and as far as I can judge, most honest and trustworthy.

27. I would beg leave here to state, that in regard to the production of Silk, the general opinion was, that the Brahmins would never have any thing to do with the operations connected with it. The result however has shown the contrary, in fact.

At KOTROOR—Several Brahmins have been employed to rear Worms and wind Silk.

At SASSOOR—Succaram M. Davee rears Worms and wind Silk himself, and intends to have, in time, a Silk Manufactory. Several Brahmin Boys also of one of the Schools there, and even the Master himself have been winding Silk.

At INDAPOOR—N. Treegoor is rearing Worms and his Sons winding Silk.

At JOONIER—B. Gampoolee is rearing Worms and intends to have a Silk Manufactory.

At CHOWAN—Limgain R. Gokla is making an extensive plantation of Mulberries and intends to have a Silk Manufactory.

AT WARGAOM KASSIMBECK.—Several Brahmins have reeled Silk in Setwa Goondgall's Establishment, and latterly great number of them there, as well as every where else, have applied for being employed in the rearing of Worms and reeling of Silk.

28. We must moreover bear in mind, that at present we have not Plantations of consequence, nor Trees in maturity, as it is only one year since we began to plant, and that every thing doing at present, is merely an experiment—when a sufficiency of Leaves to feed the Worms is procurable. Silk may be made to any extent, and then of course to some amount; the benefit to be then derived from it, will be another inducement, and encourage great number of people to embark on this speculation.

29. I would now sum up in conclusion the results that have been the consequence of the efforts to establish the Manufactory of Silk.

1st. The prejudices of the Natives have been overcome regarding planting Mulberries, rearing Worms, and winding Silk.

2nd. In the Deccan, Bombay, and Conkan, we have several Natives engaged in making properly Mulberry Nurseries, transplanting and pruning the Trees correctly.

3rd. The system introduced of transplanting the Mulberry plant without earth has been proved to succeed very well, and their transplantation is found to be very solicitous and economical, as instead of a Man removing one Tree at a time with earth, he can remove those without earth in hundreds. The Natives were astonished to see this mode of plantation so successful; and I was myself surprized to see the buds shoot out with Leaves 4 days after being transplanted.

4th. The quantity of Eggs produced by the Butterflies have increased.*

5th. The White Cocoons that were before small, are now increased to just the same size as the Yellow and Sulphur, and the Eggs are regularly hatched.

6th. Experience has now shewn, that it was not only at Kootroor Baug we had Cocoons of a quality that 10,000, would suffice to produce a Pucka Seer of Silk instead of 13 and 18,000 Cocoons as stated in my Guide, but we have that quantity also at other places, by which saving of Leaves, Wages of labourers, and room required for the rearing of Worms are effected, and the result of product increased.

7th. The capability of the Natives to wind Silk of a superior quality has been established beyond doubt.

8th. The value of a Mulberry Plantation in the sale of the Leaves has been shewn. The Leaves bought for feeding the Worms at Wargoam have been purchased by Goondgall from the Ryots at 1½ Pice the Pucka Seer, and the greater part from pruning their young Mulberry Plants under one year of age, in the Villages of Chinchoorce, Wargaom, Sawargaom, Narangaom, Goonjoolwaree, and

* In my Guide I calculated 18 Pucka Seers, and that too in the favorable season when the Worms spin quickly.

Malliongah. I attended myself as a mediator on this, the first occasion of the kind, to point out the value to them, and to give them a few observations. I had the satisfaction to see those Natives very much satisfied, and moreover to hear the Natives at Narangaom, a people, by the bye, very difficult to satisfy, call me their "Danea"; that God had sent me to them—adding, that during other years at this period, (March) in which they have no products, they generally had recourse to their Sawkars to get some money to go on with, but now they are assisted by the Mulberry.

9th. From an experiment made at Naigao, near Bombay, at Mr. F. de Ramos' Estate, it has been found that the consumption of Leaves of the St. Helena species for the Worms, from the day they were hatched until they began to spin, has been proved to be 12 Pucka Seers, (of 80 Tolas) for 1,000 Worms.*

That the very "Mutti Worms" require 31 days in Poona to begin to spin, have spun in Bombay in 24 to 26 days.

30. The Island of Bombay was declared by the best judges to be a place unfit for the Cultivation of Mulberry and the rearing of Silk Worms, but it has now proved totally to the contrary, and I am quite convinced, that this will be a place of importance as far as the Island can provide with Leaves.

BOMBAY.

NAIGAO—MR. F. DE RAMOS' ESTATE.

31. This is the head quarter of the Mulberry Plantations and Nurseries for this District, and the place in which it is intended, in time, to have a Silk Manufactory, which, from the present flattering appearance, I hope, will become an Establishment of magnitude and of extensive usefulness.

MULBERRIES.

32. It is very gratifying to see the great progress the Stan-

* I am happy to say, that the improvement made in this branch is as follows:

Deccan, at Wargaon.—I counted the Eggs of several Butterflies and found that each of them laid 240, 300, 315, 320, 345, 380, 415, and 435 Eggs.

Bombay, at Naigao.—The Butterflies laid each, 250, 280, 310, 333, 366, and 442 Eggs, and they are larger, and require only 19 to 20,000 instead of 22 to 24,000, to form a Tola weight of 12 Poona Massas.

dard Mulberries of several varieties have made, from Seed, and Slips, and how properly all are pruned.

33. The Bark of the Tree here has an Ash Colour, whilst in the Deckan that of the healthy Tree is Green. The Leaves here are larger and thicker, and are of a Darkish Colour instead of Green: several varieties, of which the cuttings planted in the Deckan succeed but very rarely, have here every one flourished. I calculated in my Guide that a Tree one year old would give 4 Seers of Leaves, but it now gives much more.

34. Having been blamed for attempting to pretend to introduce Silk in this part of the Presidency, I agreed with Mr. Ramos, that he should rear a small quantity of Worms for an experiment. The result on several trials has been in every respect most satisfactory, and always evincing improvement.

WORMS.

35. The result of the Worms reared has been as follows:

In September 1838, they had begun to spin the Cocoons in 26 days from the day the Eggs had been hatched.

In November, they spun in 27 days. It is to be remarked, that the temperature, during that month, in the room where the Worms were kept, was not lower than 78 degrees, generally 82 to 84, and on several days reached to 86 to 89.

In April 1839, the temperature was from 92 to 94, and did not affect the Worms, but they took 33 days to begin spinning.

In May, they employed 24 days and spun very fine Cocoons, the weight before being baked of some that I weighed was as follows; in this month the temperature was from 92 to 94 at noon.

11 to a Tola—and 500 to 42 Tolas.

In June, the Worms spun in 24 days still better Cocoons than in the preceding months, weighing

*8 Cocoons to 1 Tola.
8½ do. to do.

* The weather being very damp the weight of the Cocoons were heavier, but from their size it could be perceived they were superior than those of last month.

9	Cocoons	to	1	Tola.
10	do.	to	do.	
11	do.	to	do.	
50	do.	to	4¾	Tollas.
250	do.	to	25	do.
250	do.	to	24¼	do.
250	do.	to	23	do.
250	do.	to	22¼	do.

and at this time there were reared 30,000 Worms; the temperature for a few days reached 87 degrees and was generally at 82 to 85.

36. An account has been kept of the St. Helena Leaves given to the 30,000 Worms, and it was found that the consumption was 12 Poona Pucka Seers for 1,000 Worms.

37. The species of the Worms reared was "Mutti's Worms," that which in the Deckan takes generally 30 and 31 days to spin in the favorable season.

38. Mr. Ramos has also reared Dr. Hardy's Worms from Eggs brought from Italy by that gentleman, some are Large and Black, and others of Ash Colour, and they consume great quantity of Leaves.—The Eggs hatched irregularly, a few in a day: They have made tolerable Cocoons; now in more than 3 months only 15 Eggs hatched from those we had here, so that it would appear that they are not monthly Worms; nevertheless I do not despair to reduce them like mine to become so. He has begun to cross them with the others, until they are duly perfected. The first time they have spun in 31 days, now in 26.

Dr. Hardy's Cocoons have two peculiarities: 1st, the fibre is finer than mine; 2d, they have very little and almost no floss. I have however observed that this second time, the few Cocoons have a greater quantity of floss than before. They spin the Cocoons very white, also a Straw Yellow, and a Nankeen Colour. I have good opinion and expectation of these Worms; we shall see their progress hereafter.

39. In the winter the Worms will thrive very well here;

the temperature being more equal; fewer of such great changes as occur in the Deckan.

40. I had also the opportunity of making another observation regarding the Leaves. It rained all the day at Naigao in very heavy showers for several days, which obliged the Leaves to be dried before giving them to the Worms; the Worms were however fed in due time without any delay. Thus the monsoon will never be felt as an inconvenience, for when the Trees attain their maturity, the Leaves may be gathered, not in one, but 2 days, before giving them to the Worms, without prejudice.

RAW SILK

41. Specimens of the Silk spun at Mr. Ramos' Establishment have been submitted to Government and to the Chamber of Commerce, and they have been declared to be as fine as the superior Bengal Silk.

42. I cannot say much of the Plantations belonging to the other individuals at Naigao, Boowaree, Mattoonga, and Mahim; some of them are tolerable, and others in a poor state.

43. In concluding this Report for the Bombay District, I deem it my duty to say, that Mr. Ramos' enterprise, spirit, exertions and liberality towards extending the Silk Culture, are deserving great prise and commendation. It is only 15 months since he began to make the Nursery of Mulberry Cuttings, and Seed, and 12 months since their being Transplanted, and his Gardens are now filled with Mulberry Trees. He suggested to other persons to plant, gave several thousands Mulberry Plants and Cuttings, Carts, and people to carry and plant them, and to manure the whole, gratis. He has been supplying for several months Silk Worm Eggs for several quarters, gratis.

CONCAN.

BASSEIN—MR. BROWNRIGG'S ESTATE.

44. The Mulberry has not made great progress here, owing to the poor sandy soil which required more manure and irrigation, and from the plants not being touched with the pruning

knife as should have been done; however I hope to see them in the future going on famously, as Mr. Church is himself taking the deepest interest in it.

45. A part of the Leaves of the Trees exposed to the Sea-side are a little injured by the breeze, which blows very strong.

46. The Silk Manufactory would be a very good addition to the Sugar Establishment, as in both there could be kept up a number of persons always employed for one or the other, and no occasion then to pay wages to people for working only a few days of the month, and subject to the inconvenience of discharging them.

47. I am also very glad to perceive that Mr. Church has the valuable plan in view of granting Mulberry Slips and Plants, gratis, to the Ryots, in order that in that quarter also the Silk Cultivation may be extended.

KAMAN

Is a very small village (Waree), situated in a rather fine and fertile Valley, with abundant of Bamboos, Wood, and Grass, 6 miles distant in the interior from Bassein, possessing abundance of Water of very good quality. There are two means of communication, one by Land and another by Sea; the distance from Bassein the same by either. Last March I began the plantation; I made a Nursery of different species of Cuttings, Seed and small Plants, which I carried there, without earth. The other day on going to inspect them I remained quite astonished and delighted to see the incredible progress they had made. The progress the Trees make in the Deckan and Naigao, cannot at all be compared with what has been the result at Kaman. The Leaves are so large,* dark, and thick, that only a person well acquainted with the Mulberry, can distinguish the species; and had I not made the Plantation myself, I would have doubted of the rapid progress the Trees had made since they were planted.

49. I am told, that the Proprietor of that place applied

* In shady places the trees give dark large leaves, but at Kaman the plantations are in open plain.

to Government to have some waste land, existing close by, rent free for some years, with a view to cultivate Mulberries, I hope that Government will grant it, as in every respect such would be beneficial to the country and Government.

50. The Proprietor of the Mulberry Plantation intends to extend considerably; and to have, in time, a Silk Manufactory; whether this will be the case or not is not of much importance, as my great anxiety is to have number of Mulberry Trees; and as to their finding a sale for the Leaves, or winding Silk, there need be no doubt. Indeed I look upon an extensive well reared Mulberry Plantation in maturity, to be, in this country, a mine of gold.

True Extract.
W. S. BOYD,
Acting Secy. to Govt.

TO THE RYOTS WHO CULTIVATE THE MULBERRY TREE IN THE DECCAN.

In 1838 I published "A Guide on Silk Culture in the Deccan" in which, after testing its utility by the experience and trials of years, I stated my opinion regarding the advantages that would accrue to the Deccan, if the Silk Culture were introduced, and the benefits that would be derived by Ryots individually undertaking the cultivation of the Mulberry Tree, the rearing of Worms, and the winding of Silk.

2. I pointed out the great advantages and facilities afforded by the climate of this country, for conducting such operations; I shewed its peculiar adaptation for such a purpose, and its superiority over all other climates; where, notwithstanding the inconvenences under which they labor, the enterprize of the people has enabled them to derive the greatest pecuniary advantages from the Silk cultivation.

3 I submitted statements of the successful experiments made in Poona, and gave an idea of the probable benefits that might be expected; finally, I concluded by saying, that I doubted not,

that hereafter you would devote yourselves to this culture; for, once known, there is no occupation so likely to interest you as this, involving as it does so little comparative labor and fatigue; and that in fact it is absolutely necessary you should possess *some* kind of valuable cultivation.

4. Since that time Government has been pleased to form an Establishment for the Silk Culture in the Deccan, and has nominated me Superintendent of it.

5. You have been shown how to plant Mulberries which they gave you, and planted gratis. A number of people have been taught how to cultivate the Tree.

6. Worms have been reared, and are now rearing at Wargaom Kassimbek, Narrayengaom, and Dingorah; and, in the former place, Silk wound, not for the sake of profit, but, with the view of showing you the whole process of the Silk Culture, and in the mean time, in pruning your young Trees, the leaves are not thrown away, but you get already some return, people also get employment and money, and learn the different processes.

7. Now I am happy to see that the liberality which the Government has evinced, in favouring the Silk Culture Establishment, has been already attended with some advantage and success, of which it is a sufficient proof that a considerable number of you are cultivating the Mulberry Tree, and increased application are constantly made by many more.

8. You have recognized the peculiar advantages of the Mulberry Tree, and you say: "The Mulberry Tree grows straight, "erect, and over-shadows but little ground, altho' planted 13 and "16 feet distant from each other. We can plough and harrow "between the Trees, we can raise our vegetables, grains and "tobacco."

9. "In many places we see three cultivations going on in "the same spot, viz. Mulberry Trees, vegetables, and plantains, "or Limes and Goava Trees, which is a great object."

10. The Mulberry Tree does not require watching day and

night for fear of birds or thieves. No bright can spoil the produce, and there is no fear of losing the fruit, as in the case of your mangoes and other crops.

11. The weeding, manure, and water which your vegetables and fruit trees require throughout the year, are far beyond what are necessary for the Mulberry, and this even when a young Tree.

12. Some people in the three months of the hot season (Shimgah) do not cultivate vegetables, and they have only young Mulberry Trees which are attended with almost no labor, or expense; every one of you having your own bullocks and implements.

13. Several of you have planted the Trees close; the 3rd year of their plantation you will not be able to rear any thing between them all the year round, but only part of it, because there will be considerable shade on account of the quantity of leaves; but this of course will be a consequence of the produce and return being greater, so that the imposibility of sowing other products will be no disappointment, and it is a fact (as you declare yourselves) that, considering the great and continual labor that you undergo for your vegetables and grain, if you were to calculate the amount of wages, expense of bullocks, buckets, ropes, &c. the result will show nothing but loss.

14. You have moreover given the most encouraging proofs of your capacity and skill in the winding of Silk. The Silk reeled by Brahmins, Purdeshees, Silversmiths, Malees, Koonbees, and Mussulmans, has been sent to Bombay and Europe, and has been declared to be of a very superior quality, and sold at high prices, presents have been given to several Individuals in order to mark the satisfaction of Government, and encourage you.

15. So much have been already achieved by you in the Silk Culture, that it affords a conclusive proof of what may be hereafter expected.

16 .I have to repeat what I always tell you, that all depends in yourselves, were you to prosecute the undertaking with spirit and perseverance.

17. You have often complained and represented to me, that your situation was miserable, that you undergo great labor and get no adequate return, possess no comfort, the generality of you having always recourse to " Sawkars," getting so much in debt, and after all losing your Land : and unfortunately a great many of these cases are constantly to be met with.

18. Here is an ample field for your exertions, and if you stick to it, you will possess a great additional resource, which indeed, let us say again, you stand greatly in need of.

19. In other Countries they have Silk, Indigo, Cochineal, Coffee, Sugar, Spices, &c. and here you get nothing in the shape of valuable produce, and the worst of it is, that, you are entirely dependant on your Grain crops and, should the rains fail or prove scarce, your position becomes deplorable ; but by engaging in the Silk Culture you will be at all times above want, because the St. Helena Tree bears leaves all the year round, and with very little water.

20. The same will apply to the people rearing Worms, and others winding Silk.

21. The Silk Culture would afford employment to a considerable number of Women, Men, Boys, even blind and lame people.

22. Government kindly not only gave you hints, but put themselves to a considerable expense in order to improve your situation, and if you do not avail yourselves of such a favorable opportunity, it will be your own fault. Government system is, as you know, never to impose on, or force, any person, but to allow them to follow any branch of industry they choose.

(Signed) G. MUTTI,

Narraingaom, June 1841. *Supt. Silk Culture.*

DISSERTATION

ON THE

SILK MANUFACTURE

AND THE

CULTIVATION OF THE MULBERRY;

TRANSLATED

FROM THE WORKS OF TSEU-KWANG-K'HE,

CALLED ALSO PAUL SIU,

A COLAO, OR MINISTER OF STATE, IN CHINA.

LIBRARY OF THE BOMBAY BRANCH OF THE ROYAL ASIATIC SOCIETY.

SHANGHAE:

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1849.

ON THE

SILK CULTIVATION,

TRANSLATED FROM THE CHINESE.

ANCIENT REFERENCES TO THE SILK-WORM.

The earliest allusion to the mulberry and silk, met with in the ancient writings of the Chinese is in the Historical Classic, a work which existed before the days of Confucius, because it is quoted by him, and which embraces the history of China from (B. C. 2356, to B. C. 722) a period of 1634 years. In the former part of that period, we have the allusions referred to, recorded in the section called the tribute of Yû, who flourished 2200 years before Christ. In his days the mulberry is spoken of as a well-known production, and silk as obtained therefrom: so that it must have been discovered before his days. The usual tradition is, that it was discovered during the reign of Hwângté (B. C. 2640) by his queen.

The passages in the Historical Classic, in which references to the mulberry and silk are made, are as follows:

In giving an account of Yen-chow, the south-western part of the modern Shan-tung, the writer says, "The mulberry region having been supplied with silk-worms, the people descended from the hills, and dwelt in the plains." On this the commentator remarks: "The nature of the silk-worm is to abhor dampness, hence it was not till the waters were abated that the silk-worms could be reared. The nine regions of China equally depended upon this source of wealth; but the Yen province alone is mentioned because it was best adapted for the Mulberry." The classic goes on to say, that the tribute of Yen-chow consisted in varnish and

Silk, while their tribute-baskets were filled with wove stuffs of various colours. See translation of the Shoo-king, p. p. 91, 92.

In speaking of the productions of Tsing-chow, the north-eastern part of Shan-tung, the classic says, that "from the valley of the Taé mountain they brought Silk and hemp; while their tribute-baskets were stored with the wild Mulberry and Silk." The Silk produced from the mountain-Mulberry is said by the commentator to be so tenacious, that it was peculiarly adopted for harps and guitars. (See Translation of the Shoo-king, page 93.)

Black Silk and checquered sarcenets are spoken of as the production of Tseu-chow, the southern part of Shan-tung and the northern part of Këang-soo. (See Translation of Shoo-king, page 96.)

The productions of King-chow, the modern Hoôkwang, where Silk has since been cultivated to a great extent, are spoken of as consisting of black and red Silks, with silk fringes. (See Translation of the Shoo-king, page 101.)

The next classic in which we find any reference to the Silk-Worm is the Chow-le, or Account of the Ceremonies of the Chow dynasty, where it is said, that "The officer who adjusted the price of horses forbad the people to rear the second breed of Silk-Worms in one season," because, in accordance with the views of astrologers, the horse belonged to the same constellation with the Silk-Worms, and they were therefore considered of the same origin. Conceiving that two things of like nature could not prosper at the same time, the Chinese forbad the rearing of the second breed of Silk-Worms, lest it should be of some disadvantage to the horses. However absurd this notion, it shows, at the least, that the rearing of the Silk-Worm was a common practice at that period.

After this, we meet with frequent references to this subject, in the Le-ke, Book of Ceremonies. This book was written partly in the Tsin dynasty (B. C. 204), and partly in the Hàn dynasty (B. C. 135), and gives an account of the ceremonies observed by the Chinese in very early antiquity. In the 6th section of this work, entitled Yue-ling,, we meet with the following directions:

"In the first month of spring orders were issued to the forrester not to cut down the Mulberry-trees; and when the cooing doves were observed fluttering with their wings, and the crested jays alighting upon the Mulberry-trees, people were to prepare the trays and frames, with the round and square baskets, for the purpose of rearing the Silk-worms."

"In the spring season, when the empress and her ladies had fasted, they proceeded to the east, and personally engaged in picking the Mulberry-leaves; on this occasion, the married and single ladies were forbidden to wear their ornaments, and the usual employments of females were lessened, in order to encourage attention to the Silk-worms. When the rearing of the Silk-worms was completed, the cocoons were divided (for reeling) and the Silk weighed (for weaving,) each person being rewarded according to her labour, in order to provide dresses for the celestial and ancestorial sacrifices; in all this none dared indulge in indolence."

From another passage of the same section we learn, that in "the last month of summer, the order was given to the female officers to dye the Silk of various colours, in order to weave checkered sarcenets, comprising black and white, black and green, green and red, with red and white checks! all which was to be done according to the ancient rule, without the least variation; the black, yellow, azure, and red tints were all to be correct and good, without the least fault; in order to provide dresses for the celestial and ancestorial sacrifices, and standards for distinguishing the high and low degrees."

In the 24th section of the same book, on sacrificial rites, we read, that "in ancient times the emperor and his princes had a public Mulberry-garden, and a Silk-worm establishment, erected near some river; the building was about thirteen feet high, surrounded by a thorn hedge, with the folding-doors closing from the outside. On the morning of the first day of the third month of spring the sovereign, wearing a leather cap and a plain garment, ascertained by lot the chief of his three queens, with the most honourable among his concubines, and caused them to attend to the rear-

ing of the Silk-worms, in the above-named establishment. They then brought the eggs of the worms and washed them in the river above alluded to, after which they picked the Mulberry-leaves in the public garden, and aired and dried them, in order to feed the worms."

"When the season was over, the royal concubines, having completed the business of rearing the Silk-worms, brought the cocoons to shew them to the prince, when he presented the cocoons again to his consort; whereupon his consort said, 'This is the material of which your highness's robes are to be formed.' Having said which she covered herself with her robe, and received the cocoons. On this occasion the ladies of the court were honoured with the present of a sheep. This was the mode in which the presentation of the cocoons was anciently conducted."

"On some fortunate day the royal consort would proceed to reel the Silk, and thrice dipping her hands in the basin, to depress the cocoons, and seek for the clue, she would divide them among three queens, and the most honourable of the royal concubines, directing them to reel them off. Which done, they were to dye the threads red and green, black and yellow, in order to weave the checkered garments (spoken of above): when the garments were completed the sovereign would put them on to sacrifice to the former kings and dukes; all which shewed their extreme respect."

Hawae-nan-tsze in the Silk-worm Classic, says, that "Se-ling-she, the principal queen of Hwang-te (B. C. 2640), was the first to rear Silk-worms; and that Hwang-te was induced to invent robes and garments from this circumstance. Afterwards, when Yu regulated the waters (B. C. 2200), mention is made in his work on the tribute, of the land adapted for the Mulberry-tree having been supplied with 'Silk-worms,' from which time the advantage thereof gradually increased. In the Yue-ling section of the Le-ke, it is said, that in the last month of spring the trays and frames, with the square and round baskets, were to be got in readiness, for the rearing of the worms, &c. It appears on examination, that the queens and wives of the nobles, through successive generations, personally attended to the rearing of the Silk-worms; how much

more than ought the wives of the common people to busy themselves in the same. All this alludes to what was done in the Chow dynasty, B. C. 1000. It is recorded of Wán-te, of the former Hàn dynasty (B. C. 150), that he commanded his empress personally to attend to the picking of the mulberry-leaves, in order to prepare the sacrificial garments. King-té (B. C. 130) enjoined the same thing on his queen, that she might be an example to the empire. In the time of Yuên-té (B. C. 20), the empress-dowager Wang visited the silk-worm establishment, leading on the empress and the different ladies of the court, to gather mulberry-leaves. In the time of Míng-té (A. D. 70) the empress with the ladies of the princes attended to the rearing of the silk-worms. During the Wei dynasty, in the reign of Wán-té (A. D. 250), the empress attended to the silk-worms at the northern border, according to the regulations of the Chow dynasty. During the Tsín dynasty, in the reign of Woó-tè (A. D. 280), the silk-worm palace was built, and the empress personally attended to the business of rearing the silk-worms; as had been the practice during the two preceding dynasties. During the Súng dynasty, in the reign of Heaóu-woó (A. D. 460), the silk-worm monastery was built, and the empress personally gathered the mulberry-leaves, as had been the practice in the preceding dynasty. In the northern Tsê dynasty, (A. D. 490) a silk-worm palace was erected, and the empress went in person to gather the mulberry-leaves. According to the regulations of the Sûy dynasty (A. D. 620), the empress went to the appointed place to gather the mulberry-leaves. During the Tâng dynasty, in the reign of Chin-kwan (A. D. 650), the empress did the same; in the first year of the following monarch Hëèn-k'hing (A. D. 655), and in the reign of Këen-yuen (A. D. 747), the empresses all attended to the silk-worm ceremony. At the same time a decree was issued, requiring that the silk-worms should be fed in the palace, when the empress went in person to inspect them. During the Súng dynasty, in the reign of K'hae-paòu (A. D. 960) on recording the ceremonies performed at the celestial sacrifice, the prayer is given which was offered when the empress went in person to rear the silk-worms.

From all which we perceive that the empresses through successive dynasties attended in person to the business of rearing the silk-worms. By selecting these extracts from the historical documents, we have set this matter in a very clear light, and placed the whole at the head of our treatise; if perhaps the rulers of countries, looking over our representations and examining our records, may be able to discover that the silk-worm establishment has not been an empty name."

ON REARING SILK-WORMS.

In the Record of Hûng-kea, a district of Wán-chow, in the province of Chë-këang, it is said, that "in Yung-këa there are eight kinds of worms: the Yuen-chin worms, which spin in the 3rd moon, (April): the Chay worms, which spin in the beginning of the fourth moon, (May); the Yuen worms, which spin about the same time; the Gaé-chin worms, which spin in the fifth moon, (June); the Gaè worms, which spin in the latter part of the 6th moon, (July); the Han-chin worms, which spin in the latter part of the 7th moon, (August); the Szè-ch'huh worms, which spin in the beginning of the 9th moon, (October); and the Hàn worms, which spin in the 10th moon (November). Generally speaking, of all worms that comes out twice in the year, the first breed is denominated chin, precious or valuable: of the chin varieties only a few should be reared; the gae variety (which spin in July), are produced from the yuen variety (which spin in May). The yuen-chin worms, having spun in the 3rd moon (April), produce their moths and deposit their eggs; which in seven or eight days will be hatched; when the worms come out you may rear them in great numbers, and these are called the yuen, or May worms. If you wish to obtain the gaè, or July worms, take the eggs of the yuen-chin, (or April) worms, and put them in a jar; no matter about the size of the vessel; then cover over the mouth with paper, and put the jar in the water of a cold spring, in order that the cold may retard the maturing of the eggs, for 21 days after which, on their coming out, they are called gae-chin, June worms, or lovely little fellows. Let these spin, form their cocoons, produce their moths, and deposit their eggs; when, after seven days, the eggs thus produced

will be hatched, these may be reared in great numbers, and are called the gae (or July) worms. When you put up the eggs of the April worms, as above directed, let it be done in some quiet place; in the bottom of the vessel also put about a dozen red beans, and as many twigs of the winter Mulberry-tree; tie up the card on which the Silk-worm's eggs are deposited with hempen string; and let the height of the water outside the jar be even with the height of the eggs inside; for if the water outside is too high, the eggs will die, and not come out; and if too low the degree of cold will not be sufficient to check the maturing of the eggs; if this be not checked, you cannot retard their coming out for 21 days: and if you do not retard it that length of time, although the eggs be hatched, the worms will not come to perfection; if they do not come to perfection, then the worms will merely form their cocoons, produce their moths, and lay their eggs; but the eggs will not be hatched again in seven days; and not even before the next year. By obtaining a shady place, however, and plastering the vessel with mud, the production of the July worms may still be obtained.

In the work on the various elements of nature, occurs the following direction: "In the early part of the second moon (March) plaster your house all round with mud (so as to keep out the cold) as this is for the benefit of the worms."

The same writer goes on to say, "It appears that there are various kinds of Silk-worms known in the present day; viz. worms that pass through three torpors and lay their eggs once; worms that pass through four torpors, and lay eggs twice (or a second crop); also white-headed worms, head-headed worms, southern worms, black worms, some of which lay their eggs once and others twice: ash-coloured worms, early autumn worms, mid-autumn worms, advanced autumn worms, and late autumn voracious worms; variegated worms, double cocoon worms, or dupions, such as two or three worms forming their cocoons together; all these, whether they pass through three or four torpors, are to be distinguished by the different kinds of Silk which they produce. All worms, from the time when they are small, and gradually increase, until they become large and go upon the bush, should be fed with leaves from the northern and southern species of Mulberry; when small they should be fed upon the Honan and Shantung species of Mulberry; if at such a time you give them the southern species they will burst themselves."

In the Important rules for the regulation of the people, occurs the following directions: "In selecting cocoons for seed, you must do it while the worms are on the bush. Those that mount highest up will produce the thinnest Silk, and those that select a lower position, will not lay eggs! hence the middle ones should be chosen. The house where the worms are reared should have windows that can be opened all round, which must be well-pasted with paper; the partitions must also be thick, and fires must be kindled in every part of the room; for if there be fire only in one part, the heat will not be regular throughout. When the worms are first hatched, some people are accustomed to brush them off with a feather: in truth, however, a feather is apt to injure the worms; and Heuên-hoo recommends that fine mulberry-leaves be scattered over the worms, when they will creep up on them. The heat of the apartment must be properly regulated; if too warm, the worms will be dried up; if too cold, they will be late in coming out. When the worms have arrived at the state of torpor, you should be provided with three hurdles, in the middle one of which the worms should be placed; while the top and bottom hurdles are left empty: the bottom one is to prevent their being affected by the dampness of the ground and the upper one is to keep them free from dust. While the worms are yet young, place the mulberry-leaves, which you have picked, in your bosom, to make them warm; after which shred them up; this is done, because when the worms are small, they must not come in contact with dews or damp; but when brought into contact with the human body, all these evils are avoided. While the worms are feeding, open the windows and blinds; when they have done, close them; this is because the worms eat the better when they see the light, and the more they eat the larger they grow. When the worms are come to maturity, any exposure to rain will injure the cocoons; you must therefore bush them inside the house; for this purpose you may thinly scatter some twigs over their hurdles, and having disposed the worms thereon, cover them lightly over with some more twigs; on one stand you may place ten hurdles.

Another plan is, to use the stalks of a large kind of

southern-wood, instead of twigs; and when the worms have dispersed themselves thereon, to hang them up all about the beams and rafters of the house, or upon hooks and claws suspended on purpose, in layers one over the other, wherever you find a place for them. When you have suspended them all, make a small fire of charcoal underneath the twigs, to warm them; for when they are warm they work the more speedily, but when cold they are slow in their operations. Frequently enter the apartment, to observe how things are going on, and if you find it too warm, remove the fire. The southern-wood twigs are of a cooling nature; thus by using them you will avoid the evils arising from damp heat; they likewise admit of the dead worms rolling off and falling down, by which means the cocoons are kept from being fouled: they also allow the excrements to fall through, and the silk is thus kept free from spots and blemishes. When the silk is rotted by damp heat, it will be difficult to get it bleached by soaking; when the cocoons are fouled, the silk disperses in the winding; while spotted and blemished silk is useless. Hence the benefit of southern-wood twigs. Heuên-hoo says, the method of bushing by southern-wood twigs is much better than the mode at present adopted, and I cannot conceive why people will not use it.

When worms are bushed outside, should the weather be cold of an evening, they will not form their cocoons; but by using fire, this evil will be prevented, and the silk thus produced will be more easily bleached by steeping, and look brighter. By this means, also, the worms are themselves killed by exposure to the sun's rays (which prevents their perforating the cocoons), and although the silk thus produced may be white, and sometimes brittle, yet when used for the girdles of long garments, it is doubly and trebly good. What is more, by neglecting real advantages you lose the labour of the year; the firm and the brittle differing widely from each other; attention to this is the main-spring of wealth, of which men ought not to be ignorant.

Tsuy-shíh says, In the 3rd moon, at the feast of the tombs, (April 6th) you should direct the silk-worm feeders to put to rights

the silk-worm establishment, to stop up all the crevices, and prepare the stands, hurdles, and baskets necessary for the purpose.

Wâng-ching says, In rearing the silk-worms, the first thing to be regarded is the selection of the seed; in choosing the cocoons for seed, take them whilst on the bush. Hold them up to the light and separate the bright and clear from the thick and solid ones. The moths that come out on the first day are called early moths; those that come out the last of all are called late moths, both of which are to be set aside. Those which come out on and after the second day may be selected. Spread the cards on the hurdles upon the stands; and put the male and female moths together until the evening, when you may throw away the male moths; then select those eggs which the female moths have laid in order upon the cards; those which are laid in a circle, or on a heap may be rejected. When laying their eggs, they should be covered over, because if they see the light, the eggs will be too much scattered about; the cards should be made of Mulberry-bark, brought from Nân-tsin. When the moths have laid a sufficient number of eggs, these should be kept covered upon the cards three or four days, in order to consolidate them. When hung up, let the eggs be on the outside, lest the wind agitate the cards and injure the eggs by friction. They should be tied up with a string made of Mulberry-bark, and not of hemp or flax. They must be hung up in a cool place, free from smoke, and out of the reach of the sun's rays. In the winter season, or on the 8th of the 12th moon, (near about the 1st of January) when the eggs are washed let not the water be too cold. After having soaked them a couple of days, take them out, and hang them up again; when the Chinese new year is past (about the beginning of February), stick the cards upright in a jar, rather wide apart; let them be taken out every ten days when the sun is high, and after a shower of rain for the purpose of drying them.

Hwâng-sang-tsang says, "on the 12th day of the 12th moon, (about our new year) steep the eggs in salt water, and on the 24th day of the same moon take them out; which will be found of some advantage when the silk comes to be reeled. Some say, on the 8th day of the 12th moon, steep

the silk-worm cards in a lixivium of Mullberry-wood ashes, or the ashes of burnt grass, and take them out after one day; then soak them in snow water, and hang them up to dry; or suspend them in the Mulberry-trees, where they may be exposed to the snow and rain, for three days, after which take them in again, this will render the eggs more hardy. On the 12th day of the 2nd moon, (the beginning of March) wash the cards; and on the morning of the feast of the tombs (April 6th) wrap them up in thick cotton paper, and put them by in a cupboard; until the buds of the Mulberry-leaves are about half an inch long, when you should wrap the cards up in cotton. In the evening, cover them over with the warm clothes which you have been wearing during the day; and in the morning, with the warm coverlet which has been spread over you during the night. When the worms are come out, they may be warmed with fire, but before they are come out, fire must not be brought near them. With regard to the steeping of the cards on the 12th moon, above spoken of, one method is to take the ashes of burnt Mulberry-twigs, and having moistened your cards, spread these over them; then steep the cards in salt water, or rather water in which salt has been dissolved, the quantity of which must be accurately weighed, lest it exceed. Then cover the pot over with a cup or plate, and on the 24th day of the moon take the cards out. Wash away the ashes with river water, or rinse the cards in a flat basket; after which hang them up to dry, and on the arrival of spring the worms will come out; otherwise the checking of their growth by the cooling process will not be sufficient to allow of the leaves coming out in time for them. On the 12th day of the 2d moon, as spoken of above, wash the cards in water wherein have been bruised the flowers of the mustard, or wild mustard-seed, the flower-buds of scallions, or peach and pea-blossoms. When the moths deposit their eggs, take only those which are deposited in one night, otherwise the worms will come out at different intervals."

Let the Silk-worms' eggs be left to themselves, as to the time of their changing colour, be it early or late; do not injure or bruise them, and they will change colour of themselves. When the Mulberry-leaves have come forth, in the early part of some day, take the cards out of the jar, and unroll them. There is no particular rule to go by in this matter, but when on the first day of inspection they have changed colour about one-third, and on the second day two-thirds, then paste some paper over them, and return them into the jar. On the third day at noon, again take out the cards and unroll them, and you will find them wholly changed in colour. Previous to

this, the Silk-worm apartment, stoves, and Silk-worm hurdles must all have been prepared. The apartment should be high and roomy, the windows and doors light and airy, so as to enable you to distinguish easily when the worms are about to fall into or awake from their torpor. Above, there should be arranged some sky-lights among the rafters, so that in the twilight of morning and evening, you may obtain a little extra light. Below, near the ground, there should be a row of ventilating holes, which may be opened and shut, in order to prevent dampness. If the walls be damp, from having been newly-plastered, you should fumigate and dry the apartment with live fires. Let the windows be newly pasted over with clean white paper;* and let screens or mats be hung up at every door-way. When the young worms come out, do not brush them about with a feather, or such like instrument, but carefully and gently place them at equal distances, without injuring them, or huddling them together. When they have all come out, take some leaves that have been warmed by being put in the bosom, and shred them up very fine with a sharp knife; sift these into a vessel thinly but equally spread over with layers of rumpled paper; then take the card and turn it over on the leaves. When the little worms smell the leaves, they will descend of their own accord from the card; those worms which at the time of removal will not leave the card, or crawl about on the back of it, can be rejected.

In rearing the young Silk-worms, first open out an apartment on the east side in each corner of which arrange a few stoves placed in a triangular form, in order to produce a regular heat; should the apartment be small, it will be the more easy to warm it. Just before and after the torpor, you may remove these. Having selected a proper day, arrange your stands, on each partition of which, above and below, put three hurdles, the upper one to catch the dust, and the lower one to screen off the dampness; put also some loose straws on the upper and lower hurdles, to be in readiness for the separating the worms and removing their excrements. Get some finely-chopped and well-pounded straw, and

* The Chinese seldom glaze their windows, but use instead of glass white paper pasted on lattice-work.

scatter it evenly for a bed; upon this arrange some clean rumpled paper, forming a pallet on which to place the Silk-worms. When they first come out, the little worms are black, but increase their food by degrees, and in three days they will gradually turn white; they are then bent on eating, in which case their food must be increased a little; when they turn of a greenish hue, they are regular devourers, and their food must be still more increased. After this they become white again, when they eat more slowly, and their food must be a little diminished; subsequently they become yellow, when their appetite decreases, and their food must be diminished still more; lastly they become of a pure yellow, when they stop eating. This state is called the regular torpor; after this torpor, they change from yellow to white, and from white to green; again from green to white, and from white to yellow; after which they fall into another torpor.

The Szé-nùng-peih-yúng* says, When you have to feed the young worms, you should water the Mulberry-Trees the evening before, and then pick the leaves; by so doing, the leaves will have abundance of flavour, and will not be dried up when you pick them. You should shred these fine with a sharp knife, pass them through a wide sieve, and spread them thinly over the worms. If your knife is not sharp, there will be no flavour in the leaves; and if you do not shred them up fine, they will smother the little worms; without sifting them also, you cannot distribute them evenly. Being unequally distributed the worms will be irregularly fed. The volatile flavour of the leaves cannot long be retained, and in a very short time they become dry and withered; therefore you must as soon as you have shred them up, pass them through the sieve for use. The above is the order of their change of colour after each successive torpor, by watching which you may know when to increase or decrease the quantity of food. The leaves must never be given when wet with rain or dew; nor soon after being dried in the wind or sun. If leaves are given to the worms in a damp state, they occasion all kinds of sickness. It would be better to have a supply of leaves ready, three days pre-

* Important Rules for scholars and agriculturists.

viously, lest they should be in any wise damp with rain; thus the worms will always have dry leaves, and will not suffer from hunger. When you have gathered the leaves and brought them home, scatter them lightly about in the house, until they have lost something of their heat, after which you may give them to the worms. Each day, during the silk-worm season, may be generally divided into four periods, the mornings and evenings may be compared to spring and autumn, midday to summer, and midnight to winter. The cold and heat will be found to vary, and if you seek to raise the temperature by fires, you must carefully adjust the degree of heat, which should by no means be always the same. From the first hatching to the second torpor, the worms require warmth. Let the woman who takes care of the worms wear only a single garment, and then she can judge by her own feelings how to treat the worms; if she feels cold, the worms will also be cold; in which case the heat should be increased; if she feels warm the worms will also be warm, and a proportion of the fuel must be removed. After the first torpor, should the weather be genial, some time before noon, you can gradually open the windows and remove the screens, to let in the sun and air. Should the wind be from the south, open the windows on the north side; and if from the north, open those on the south side; letting in the air in the opposite direction of the wind, which will keep the worms from injury. After the great torpor, having given them three meals, cut away all the paper from the windows, to give a free passage to the sun and air, but be careful not to frighten the worms into sickness. At this time, should the weather be warm, in addition to throwing open all the doors and windows, place some jars of water, continually renewed, at the doors, in order to increase the coldness. Should the weather be stormy, however, and the nights cool, you must let down the blinds and screens. During the whole interval, from the hatching to the maturity of the worms, as they increase in size, you must remove them to separate hurdles; and when their excrement is abundant, remove it, for if you do not separate them, they will soon be too much crowded; and if you neglect to remove the excrements, hot damp will be generated. Silk-worms are very ten-

der things, and cannot bear being rubbed or pushed: while they are young, people know that they must deal gently with them; but when they are large, in separating them or removing their excrements, people sometimes lazily roll them about without any regard; or leave them for a long time huddled up in confusion, or pitch them high and throw them far, from which causes much injury and sickness arise. After the great torpor, silk-worms come to maturity in the course of fifteen or sixteen meals: and the quantity of silk likely to be obtained depends very much on this season. Silk-worms in the north generally go through three torpors, but those in the south of China, four. When you observe them every day approaching maturity, calculate their weight in order to reduce their food; and when nine-tenths of the worms are come to maturity, you can put them on the bush. If bushed outside in rainy weather, the cocoons will be spoiled. The plan in the south of China is to bush them in the house; and in the north, to bush them outside. In the south, they adopt the plan of bushing them in the house, because the worms are few, and easily managed; but when they are numerous, it is difficult to find room for them all. The worms in the north being numerous are bushed outside, but they are very generally pressed, crowded, and obstructed. Thus both the northern and southern plans have their inconveniences. We give here the advice of an experienced rearer of silk-worms: Between the northern and southern regions, when the silk-worms are few, with the doors and windows all set open, the system of house-bushing may be adopted; but when the silk-worms are numerous, it is better to select a place in the court-yard, in which you may erect a long thatched shed, to put the silk-worm bushes in; let this shed be provided with frames, on which spread some twigs of southern-wood; arrange the Silk-worms thereon, screen the whole in with matting, and no injury will accrue in the bushing process. This will be found an excellent plan.

Something may be said, also, regarding the summer and autumn worms. Summer worms, from the time of hatching until maturity, must be kept cool; but the flies and musquitoes must be guarded against. The autumn worms must be kept cool at

first, and gradually made warmer, because the weather at that time becomes gradually cooler. The system of bushing and reeling is the same with these as with the spring worms. The Silk of the southern worms in the summer season, is not adapted for reeling, but is only good for stuffing, wadding, &c. Cocoons in general should be quickly gathered up as soon as formed, and thinly spread out in a cool place, which will delay the moths in eating their way out, and prevent the necessity of haste in reeling off the Silk. Should there still be a fear of not getting the cocoons reeled off in time, you can steep them in jars, or steam them in baskets.

The Learned Agriculturist's Vade-mecum has the following statements regarding the reeling of the Silk: the true secret thereof consists in having the thread equally fine, round, even, and of proper tension; it must not be flat, loose, wasty, knibby, coarse, or uneven. Some use warm vessels, and others cold ones in the reeling. If warm vessels be employed, they must be large, fitted upon a furnace, and be about three-fourths full of water. Sometimes the middle is separated by a board, and then two persons may reel at the same time. The water must be hot enough to make the cocoons whirl round and sink; if too many sink, however you will not be able to reel fast enough, before the cocoons become spoiled by the hot water. In this way, you may reel coarse Silk by single or double hanks; but the reeling by the cold-pan system is the best, as from it the Silk comes out cleaner and more glossy. The cold pan should be large, and plastered with the mud on the outside; when used, let it be nearly filled with water which must be constantly kept of a moderately tepid temperature, neither suddenly cold nor hot; by this means the silk may be reeled in whole hanks, and of a fine size. From cocoons of a middling quality, you may reel off double hanks, and obtain the Silk more excellent in appearance and of a stronger and tougher quality, by the cold, than you could by the hot process.

If the most essential things connected with the process of reeling in the northern and southern districts were recorded in a book, to constitute a manual of directions; the rearers of silk-

worms, by adopting its more important hints, would be enabled annually to attain to greater perfection; by means of which, the revenues of government would be greatly benefitted, and the people provided with a warm and useful material for clothing. Than which no plan could be more advantageous.

Màng-kë, of the Yuen dynasty in a discourse on the nature of the silk-worm, contained in his Treatise on the Cultivation of the Mulberry, says, "The nature of the silk-worm requires, that while on the card it should be kept extremely cold, but when first hatched very warm; reviving from its first torpor, it should be kept rather warm; after its principal torpor, it should be kept cool; when approaching maturity, it should be gradually warmed; and when put on the bush, kept very warm."

Hwang-sang-tsang says, "Silk-worms naturally love quietness and abhor noise; therefore they should be reared in a quiet house; they like to be kept warm and dislike damp, hence they should be reared in a house with a boarded floor. A quiet house will of course be free from the noise of men; a close apartment will keep out the blasts of the southern wind; and a boarded floor will prevent the rising of damp exhalations from the ground."

A new work on attending to the most important thing, says, "The most essential thing in rearing silk-worms is the selection of seed. It has been usual in selecting the seed, to bundle the moths all together upon the hurdles. Having perhaps been much occupied with reeling the silk, as soon as the moths come out, people allow them indiscriminately to deposit their eggs, and then huddle and press them together, so that they steam, on account of the heat thus generated, are hatched too soon, and thus never come to perfection. The case of the sickness of a parent descending to the offspring is thus exemplified. But henceforth when the worms are upon the bush, it will be necessary to select those which mount upwards towards the light, or get up into the thatched covering, for these will be found to be the strongest and healthiest cocoons. Let these be taken out and put into an airy room, arranged one by one on a clean hurdle; as soon as the number of days is

completed, the moths will come out, without any steaming, huddling, or protracting; this is a good plan for preparing the seed before it is produced. Should any of the moths have bent wings and bald eye-brows, or shrivelled legs, and wings, or scorched tails yellow with smoke, or red bellies without hair, or black veins, bodies, and heads, or be produced too early or too late, set them all aside as useless; reserving only the round perfect, plump, and good moths. Select a light cool room for placing the hurdle, and spread out the cards; underneath the hurdle the ground must be swept clean. For cards, thick paper is preferable because thin paper will not bear soaking."

The work called the Learned Agriculturist's Vade-mecum says, The whole affair of rearing Silk-worms depends on being careful at the commencement, in order to prevent subsequent evils. The worms falling into or awaking from their torpor at unequal periods is owing to their being hatched at different times; and such irregular hatching is in consequence of our not selecting the seed properly. Hence the necessity of being careful in the commencement. In selecting the cocoons, choose those which are about the middle of the bush, and on the south-east, with those which are translucent, clean, full, and plump. Those that come out on the first day, are called early moths; these cannot be employed for seed. Those which come out on the next and following days can be used. Those which come forth on each successive day, should be noted in a class by themselves, and the days marked on the card. Afterwards, when you put down the moths for breeding, take only those of one and the same class; those which come out on the day following, may also be reckoned of the same class; but not those which come out three days afterwards; because when their eggs become worms, they will fall into and awake from their torpor at irregular intervals, which will be very injurious. They may, however, be reared as a separate class, apart from the others. Those which come out last of all, are denominated late moths; these must not be used. Place your cards on the hurdles upon the stands, and put both male and female moths on at once; you should take up the hurdles three or four times a day, in

order to remove the filth, but after two o'clock in the afternoon the male moths must be removed.

The New Work on attending to the important thing, says, Late in the autumn, before the Mulberry-leaves have turned yellow, they may be gathered in considerable quantities, and having been dried, may be pounded small and stored away in a place where there is no smoke. Such leaves may be given to the spring-worms after their torpor.

The Learned Agriculturist's Manual, says, The Mulberry-leaves must be gathered just as they are about to fall; if picked earlier, the buds of next year's leaves will be injured, and if later, they will have lost their sap and flavour. The jar in which they are kept must be plastered over and kept close. In the 12th moon (January) these may be beaten and ground into a powder, to be used as a remedy against the heat to which the worms are subject; what is over may be given to the cows who are very fond of it.

The Woó-pún-sin-shoo says, On the 8th day of the 12th moon (beginning of January), steep some green pulse in fresh water after which spread it out thinly to dry; also take some clean-washed white rice, and dry it; store up these two articles in a dark shady place, to be ready against the time when the worms wake up from their great torpor, when it may be mixed with an equal quantity of leaves, and given them to eat.

The same work says, In the winter months collect a heap of cow-dung, which on the approach of spring may be worked up into cakes, and dried; these when burnt emit an odour that is agreeable to the worms.

The same work says, In the winter months cut down some coarse grass wherewith to make beds for the silk-worms.

The Agriculturist's Manual advises also to prepare some yellow southern-wood twigs with bean-stalks, and mulberry branches (to be ready for bushing the worms.) Also to get ready the mats and bushes (for bushing the worms), in making which both

straw and wild grass will do; but they must be tied and woven close together; those twigs and straws which are cut even at one end, with the other end left of unequal lengths, may be used for bushes; while those which have both ends cut even, may be used for mats and pallets. All the implements used in the rearing of silk-worms, such as the stands and hurdles with the reels used in the reeling of silk, must be large and roomy. The knives with which the leaves are shred, should be broad and sharp; the square baskets should be eight feet long and six wide.

The Tsê-mîn-yaou-shuh, Important Hints for the Benefit of the People, says, The house in which the silk-worms are reared should have windows that may be opened on all sides; the walls should be papered, to keep in the heat. When the worms are young, burn some cakes of cow-dung, which will create no smoke; let these be piled up in niches round the room; and if there be no niches in the walls, place the stoves opposite the four corners of the stands and hurdles. The temperature must be properly adjusted, for if the heat and cold be not kept even, the worms will fall into and awake from their torpor at irregular periods. Until lately people have not been in the habit of using smouldering fires in the silk-worm apartments, and formerly they made use of charcoal, wood, and other fuel, by which means much smoke was occasioned and the worms became affected and blackened thereby.

The Agriculturist's Manual says, In making a stove in the middle of the apartment, a hole should be dug, in depth and width corresponding to the size of the room; for a room of 40 feet long by 20 wide, a hole four feet wide will do; all round the hole let there be brick-work, to the height of two feet; let this be plastered with durable cement, the depth of the hole and the brick-work together may be about four feet. Spread a layer of dry cow-dung, broken fine, at the bottom of the hole, about three fingers in thickness: then a layer of roots and knobs of coarse dried wood, five inches or more in thickness, over the cow-dung. On the wood let there be another layer of cow-dung filling up therewith the vacant spaces between the pieces of fire-wood; let there be no hollows, for if there be, the fire will blaze up, to

the danger of the house; besides which a live fire will not last long. Let the layers of wood and cow-dung thus alternate, till the hole be full; and cover the whole over with a layer of cow-dung. About seven or eight days before the worms are hatched, kindle some fire on the top of the cow-dung, when black and yellow smoke will ascend for five or six days. One day before the worms are hatched, open the door a little, to let the smoke out, after which close it again, lest the heat should escape; the wood and cow-dung will then sink down together, and produce a smouldering fire.

When the worms are small, they need warmth, but dread smoke; hence you must not make a flaming fire; besides which, a flaming fire sometimes burns fiercely, and at other times goes out, so that the heat from it is not equal; a smouldering fire, however, has no smoke, and will last for a long time. Should it be occasionally too low, you can stir it up with a stick, and the smoke will again ascend. The close stove now alluded to is built up a couple of feet high, to allow the heat to arise and diffuse itself equally through the apartment; also to guard against persons, who may be walking about in the dark, falling into it by mistake.

The silk-worm apartment should be dry and well ventilated, and the walls capable of retaining the heat. The little black insects must be driven away by fumigating the apartment previously with cow-dung, which will be for the benefit of the worms. Strip off, likewise, all the old paper from the windows, and paste up clean white paper instead.

The same work goes on to say, upon the upper and lower hurdles you should scatter some chopped straw, and upon the middle hurdle spread a layer of finely-chopped straw, pounded till it is soft, for a pallet. Let this be spread evenly about; near the four sides, however, you can leave about five or six inches of the bare hurdle. Then rumple up some clean paper into rolls, and spread it over the pallet on the middle hurdle. The paper should be rumpled up, till it becomes as soft as cotton.

The Yaou-she says, The bottom hurdles should consist of two; and after the worms are hatched, every day when the sun is high, take out one of the bottom hurdles, and warm it in the sun; when the sun begins to de-

cline put this hurdle again underneath the hurdle containing the hatched worms; the next day you can take out the lowest hurdle and warm it in the sun, and as before put it under the hurdle containing the worms; thus producing a little natural heat; after the worms have revived from their first torpor, you may discontinue this practice.

The Woo-pun-sin shoo says, about the time of the Tsing-ming festival (April 6th), take the silk-worm cards that have been put up in the jar, and removing them to a warm room, where there is no current of air, hang them up midway between the floor and the ceiling: not too high, lest they should be affected by the wind; nor too low, lest they should be injured by the dampness of the ground. At the Kuh-yu festival (April 22nd), take out the cards; and expose them to the sun and air, turning them inside out, those that have been rolled up to the right roll to the left, and vice versa; roll them up the contrary way every day, after which put them up again. When the worms are about to be hatched, let them be kept out of the sun and air and they will all come out together.

The Yaou-che says, after the Tsing-ming festival (April 6th) the eggs begin to turn red, and look plump and full; again they change to a round pointed shape, with a part in the middle, of the colour of the willow-leaf in spring; after this the eggs change again, and become round and flat, the centre being of a hazy colour like distant hills; these are the kind of eggs that will produce a good return; but those which are flat on the top, dry, and of a greenish yellow, or purple red colour, are unprofitable eggs, and may be thrown away.

The Agriculturist's Manual says, The silk-worm's eggs changing colour, whether at an earlier or later period, must rest with themselves: do not injure them by attempting to force it. The plan is, when the Mulberry-leaves come forth, about eight or ten A. M. to take out the cards from the jar, and put them in the sun and air; then unroll them, and hold them up with the back of the cards towards the sun, warming them a little, but not so as to make them hot. There is no certain plan for rolling and unrolling the cards; only observe, that when on the first day about one-third have changed of an ash colour, they may be put up; and if on the second day they are about two-thirds changed, they may still

be put up, and the mouths of the jars in which they are kept very closely pasted over with paper; on the third day in the afternoon, take out the cards and unroll them, when they will be found to have wholly changed colour.

The Sang-tsan-chih-shwo, Plain description of Mulberries and Silk-worms, says, "If you wish them to come out a little quicker, you must unroll them rather more frequently, and roll them up loosely; if you wish their coming out to be protracted, you must unroll them less frequently, and roll them up tighter."

The Sze-nung-peih-yung says, The worms generally come out at a season between cold and heat, there is a method, however to be observed in opening out and putting away the cards, to prevent the worms from being some earlier than others. The method is this; when they have all changed of an ash colour, put the cards two and two together, and having spread them on a clean mat roll them up tight, bind up the two ends, and put them to stand in a clean airy room, where there is no smoke; on the evening of the third day, take out the mat and unroll it; if the worms be not then come out, it will be the better; should any of them have come out too soon, brush them away with a feather as useless. These are called galloping worms, the rearing of which would make all the operations irregular. Then roll up every three cards loosely into one roll, and place them in the new warm silk-worm room. Wait until daybreak, when you may place the cards singly on a hurdle in the court-yard; though if the dew be falling, it would be better to spread them out in a cool hall, or in an open shed: after about a quarter of an hour, remove the cards into the silk-worm room, and spread them one by one on a mat, when in a little while, the black worms will all come out at once: then weigh them, cards and all, and note down their weight.

The Po-wan-lo, Record of general information, says, Take some leaves of the ground-mulberry, and shred them as fine as hairs; scatter these on a clean sheet of paper, and place the silk-worm cards upside down thereon; the worms, smelling the leaves, will

descend of their own accord; you must on no account brush them off with a feather.

The Woo-pun-sin-shoo says, The country people, in order to get the worms to descend, used to employ peach branches wherewith to beat on the back of the card; and when the worms were dislodged from it, they used to sweep them up together, and wrapping them up in paper, weigh them, after which they would spread them on the hurdles; by which improper mode of proceeding the worms were very much affected by sickness. Now, however, let a different plan be followed; when the worms are about to be hatched, you should prepare the little straw pallets, spread evenly and softly; you may also burn a few dates in the stove to create a pleasant smell. After this let the card on which the silk-worms' eggs are, be accurately weighed; then place it gently on the pallet. If you want the worms to be regularly and widely disposed thereon, you must frequently move the card along. After they have all been hatched, and dislodged from the card, weigh the empty card, and you will know the weight of the worms. If silk-worms are hatched in this manner, failures will seldom occur. Up to this time, the method has generally been to put down two ounces of newly-hatched worms on one small mat, by which means they get huddled together, and press too closely one on another, invariably tending to the injury of the worms. Henceforth a new plan should be followed, viz. to put down three ounces of little worms, and spread them equally over one large hurdle, but be careful not to put too many together. If you suppose that you have greater means of rearing them, and through desire of increase, put four ounces of worms on a hurdle, capable of accommodating only three; and afterwards find that your mulberry-leaves, your accommodations, your implements, your labourers, and your fuel, are all insufficient, then you will lose your labour and your worms too, which will be a double failure.

The Sze-nung-peih-yung says, Let the worms be carefully, gently, widely, and evenly distributed, so that they be not alarmed, injured, huddled, or crowded together. When the worms have all come out equally, take some new leaves and shred them up very

fine with a sharp knife. You should shred these leaves at the time of the worms coming out, when there will be some flavour in them; if you do it some time previously, the flavour will be gone. Pass these through a sieve, and let them fall on the pallet and paper in the middle hurdle, but see that they be distributed thinly and equally. It is necessary to use a sieve in order to produce this effect; for if they be not equally distributed, the worms will be but partially supplied with food. For sieves you can use plaited bamboos or withes. The bottom of the sieve may be about the size of a basin, and the holes large enough to admit a very small finger. Let the cards be inverted over the leaves, and the worms will of their own accord crawl down to them. If, after a considerable time, any of them have not descended, or if any crawl upon the back of the card, you can throw them away with the card; they are bad or diseased worms.

Upon the pallet of one hurdle, you can deposit about three ounces of worms, which, when the worms become large, may be disposed upon 30 hurdles. Thus for every tenth of an ounce of little worms, the full-grown worms will require a whole hurdle to themselves. These hurdles are ten feet long by two feet wide: should they be smaller, you must reduce the quantity of worms deposited on them. If you deposit too many, the worms will be too much crowded, which will be an evil. Should any wish to rear more silk-worms than these, they must increase the number of their hurdles; if fewer, they can deposit them in flat baskets.

The same work gives some directions regarding the increase or diminution of heat. When the little worms are hatched, they must be kept very warm; because at the time when they come out the weather is still cold. After their principal torpor, they must be kept cool, because at that time the weather has become warmer. Besides which, there are the unforeseen occurrences of wind or rain, fair or foul weather, and the variations of temperature between morning and evening, day and night; in all of which circumstances should you err as to maintaining the proper degree of heat in the apartment, the silk-worms will become diseased. But if proper regulations be observed in the silk-worm apartment these evils may be avoided. In constructing such an apartment, there should be windows capable of being opened all round: in the centre there should be a stove containing a smouldering fire, so that if the worms need heat, owing to the cold of the weather, you can shut down the windows and stir up the fire, which will keep out the external cold, and increase the heat. Should it be very cold, stir the smouldering fire more frequently; should the cold be still more intense,

you can in addition burn some cow-dung cakes, which give out no smoke, and put these in every corner of the building; after which the heat of the apartment will be sufficiently raised. When the cold passes away, remove your additional fires. When the silk-worms require coolness, owing to the heat of the weather, close up your smouldering fire, and open the windows, whereupon the internal heat will abate, and the cool air get admission into the apartment. Should it become very warm, open all your windows. Should the heat be still great, then take away the paper from the windows above, lift up your sky-lights, and below open some holes for ventilation besides the windows: underneath the frames, sprinkle some fresh water, and the cool air will find its way through the apartment. After the heat is passed, repair your paper windows, and stop the ventilating holes. In this way, you may cause the silk-worms, from beginning to end, to escape the inconvenience of cold and heat; their sicknesses will be few, their cocoons properly formed, and your whole establishment will succeed. But when it is cold, you must not suddenly increase the heat, but bring your fires in by degrees; for if the worms pass suddenly from cold to heat, they will become yellow and pulpy. So also when hot, the cold must not be suddenly introduced, but the windows be opened gradually; for a sudden change from heat to cold, will cause the worms to change and die. All this should be attended to: moreover, if when the worms are very hot, they are suddenly made cold they will be unable to eat; in which case, use a chafing-dish full of burning cow-dung cakes, which produce heat without smoke, stir this up with a fork, and putting the chafing-dish under the silk-worm frames, pass it backwards and forwards, to take away the cold air, and the worms will again take to their leaves.

The Woo-pun-sin-shoo says, The worms must be fed night and day; if the meals be given frequently, the worms will advance rapidly to maturity, and if seldom, they will be long in arriving at the mature stage. If this stage be arrived at in twenty-five days, it is calculated that each hurdle of worms will produce twenty-five ounces of silk; if in twenty-eight days, then each hurdle will produce only twenty ounces; but if the worms are a month or forty days in coming to maturity, then each hurdle will only give ten or a dozen ounces. The Silk-worm feeders must not be too fond of sleep, nor impede the business by their idleness. After each time of feeding, it would be well for them to go and look round the hurdles again; to see that the leaves are equally distributed. If the weather should be cold and rainy, before feeding the worms, use a few dry mulberry-twigs, or a bundle

of skeleton leaves, the substance of which has been eaten, and lighting them make a blaze about the hurdles, in order to drive away the damp and cold; after which you may feed the worms, and by this means preserve them from sickness. When they begin to fall into their torpor, you may wait until they are altogether fallen into a state of inactivity, before you discontinue their food; and do not supply them with food again until they are all fully aroused. If, when they are only three parts awakened, you supply them with leaves, they will certainly arrive at maturity at unequal periods, besides being otherwise much injured. From their first sleep to the great torpor, when the worms are beginning to slumber, if you perceive that they assume a yellowish brightness, stop their food and put them asunder; and when they are all roused together, give them their food slowly; on which occasion the leaves must be thinly scattered, for if thickly given, it will increase their loathing of food. Generally speaking, in rearing silk-worms, attention should be paid to diligent feeding, particularly avoiding leaves wet with dew or rain, the giving of which would cause much sickness.

Han-she, in his Plain Directions, says, The following is the method pursued with regard to reducing the food when the worms fall into torpor. When they are about to sleep, calculate the proportion of those which are of a yellowish white colour, and reduce the leaves accordingly, taking care to have them cut finer, more thinly scattered, and more frequently given.

If for instance one-third of the worms assume a yellowish brightness, then diminish one-third of the leaves, and let them be a little more finely shred, thinly spread, and frequently given than ordinarily. If the half are thus, then the half of the leaves should be diminished, and the shredding, spreading, and feeding, should be rather more fine, thin, and frequent. When the worms are three parts of a yellowish brightness, then reduce that proportion of their food, and let the shredding, spreading, and feeding be exceedingly fine, thin, and frequent.

When the worms have all assumed a yellowish brightness, then whether the weather be fine or rough, and the time early or late, they must be immediately set apart. For this purpose let fresh hurdles and mats be in readiness, that there be no mistake. When

you set them aside, stop their food, and when they are all aroused give it them again; this is the method alluded to above. We should also say, reduce and remove the leaves of the worms when about to sleep, lest they be pressed down by their weight; and be very careful to afford constant nourishment to those worms which have not fallen into a state of torpor, that they may more speedily arrive at that state, by which means not only will their waking and sleeping be regular, but they will be exempted from the sickness arising from the hot steam and pressure of the leaves. It has been said, that if you study this method properly, you will every year obtain finer silk; it must therefore not be neglected.

The Woo-pun-sin-shoo says, In removing the worms from one hurdle to another, let many hands set about it; that it be quickly done; if you bundle them up in a heap on the hurdle, the worms will perspire and become sick. Gradually diminish the number on the hurdle, and remove their excrements frequently; for if you allow these to remain long, they will generate heat, and the heat will produce steam, which will cause many to die of the white sickness. Every time you remove the worms, dispose them more widely apart on each hurdle; for if they are too thickly spread, the strong will obtain food, and the weak will go without it. It is also necessary to go frequently round the hurdles, to see that all is right: when the silk-worm room is close, and you suddenly open the doors, and allow a cold current of air to enter, the worms will be affected with the red sickness. In spreading out the worms, you should touch them gently, and not let them drop from above; for if you do this, the worms will get knocked about and injured, on which account the worms frequently fail, are backward in spinning, and the chrysalides become red.

The Yaou-che, Important Record, says, Should the worms get the white sickness, this must have originated in the injury sustained during the gloomy weather, when they were very young. To remedy this, as soon as the weather becomes fine, proceed without delay to get three or four sieves, and having aired them in the centre room of the silk-establishment, remove on to them the contents of one hurdle, and then of another; when after having enjoyed the warmth of the sun, the worms will recover.

The Yay-yu, Village Discourses, says, When silk-worms are

kept warm, dry, and loosely-disposed, they will not get sick; but when they are baked to a cake, or allowed to remain damp and crowded together they will be indisposed. When this is the case, you must immediately set them apart, if that can possibly be done; but should the weather be cold and rainy, you had better not remove them; instead of which you may make use of coarse grass, cut into little bits like peas, about a peck or two for each hurdle; let this be lightly scattered over the silk-worms; upon the chopped grass scatter some leaves; as soon as the worms climb up on the chopped grass to eat the leaves, you can clear away the excrements from underneath; and when the weather is fine, remove the worms to another hurdle. If you have no coarse grass, straw will do.

The Sze-nung-peih-yung says, The setting apart or removing of the worms, in order to be advantageous, must be done frequently, gently, widely, and evenly, thus they will not be injured by damp or concussion.

When the worms grow much, they must be separated; when their excrements abound, it must also be removed: if the former be not attended to, the worms will soon be too much crowded; and if the latter be neglected, it will generate damp and heat; hence these operations must be frequently performed. Silk-worms are very tender and delicate insects, hence they must not be roughly handled. When they are still young, people are generally very careful in removing them; but when they grow larger, the same care is not manifested. Some persons leave them for a long time huddled, or confusedly mixed together: or even throw or toss them about; the sickness and injury of the worms spring in a great measure from these causes: hence the necessity of gentle usage and roomy accommodations for them.

Should any of the worms be irregular, in passing through their various stages, you should feed them the more frequently, in order to bring them into regular training; thus the later ones will overtake the others, and all will become regular.

The irregular torpor of the worms, must have originated from a defect in their early treatment, hence it is necessary from the commencement to seek to prevent this evil. If amongst the purely yellow worms, you observe some rather white, and only approaching to yellow; as these are not very far behind the purely yellow you can feed them a little more frequently, in

order to bring them to an equality; in which case the latter ones will get up with the others, and by frequent feeding, you may be able to hasten their period of torpor. But if you perceive amongst the purely yellow, some that are of a greenish white, these you may conclude are very far behind the purely yellow ones, and even the most frequent feeding would not bring them up to the others. With regard to Silk-worms, their change of colour is only one of their minor changes, but their torpor, with their refusing to eat, and moulting their skins, may be reckoned among their great changes. Their passing over into the chrysalis and butterfly state, is a still greater change, and may be considered an entire transformation. Whenever the worms assume a purely yellow colour, they contract their mouths, refuse to eat, and fall into a torpor: just like human beings, when they have any great sickness, the blood and other fluids of their whole bodies, undergo a great change; if they are left perfectly quiet, for a day and a night, without being disturbed, they will fall into their torpor in the regular way. If at such a time, you should disturb the mass by feeding them, for the sake of those among them of a greenish white colour, they will be prevented from falling into their regular torpor. If you wait, also, until the greenish white ones have turned yellow, and are disposed to sleep, then the proper period for torpor of the mass will be passed, and they will be ready to wake up again. When the worms first revive from their torpor, they must be supplied with a small quantity of food: just like people, when they are just recovering from sickness, must be sparing in their diet, to suit their feeble state. If now, on account of the later ones, who are only just fallen into a state of torpor, you restrain the appetites of the mass, and do not supply them with food, you will distress and famish them; The later ones had better therefore wait for their food until they have been aroused; for if they have many diseases they will produce less silk, which will be very lamentable. Hence the Silk-worm Classic says, When the silk-worms fall into and awake from their torpor at irregular intervals, the silk will be deficient in quantity; which is very true.

The woo-pun-sin shoo says, In feeding the young worms, shred up the small leaves, as you need them, and sift them through a fine sieve; do not stop from repeatedly feeding them, but give them about two meals an hour, both night and day: amounting to forty-eight meals, or at least thirty-six meals; if you neglect this through indolence, the worms will become crooked and stunted. It is said, that the young worms eat only the sap and goodness of the mulberry-leaves; therefore if their meals be not frequent, they will be like infants at the breast, who, if deprived of milk when young, will when older become meagre and weakly, if they

do not actually fall sick. You should, on the evening previous, gather some of the finest leaves from the south-eastern branches of the trees, store these up in jars, and shred them fine for the worms.

The Sze-nung-peih-yung in giving rules for feeding the young worms, says, you should water the mulberry-trees the evening before and then pick the leaves; by so doing, they will have abundance of flavour, and will not be dried up: when you pick them, you should shred them fine with a sharp knife, pass them through a wide sieve, and spread them thinly over the worms; if you cut them with a blunt knife, the leaves will not emit their flavour; and if you do not shred them up fine, they will smother the little worms; without sifting them, also you cannot distribute them evenly. Being unequally distributed, the worms will be irregularly fed. The volatile flavour of the leaves cannot long be retained, and in a very short time, they become dry and withered; therefore you must, as soon as you have shred them up, pass them through the sieve for use; on the 1st day you must feed them twice an hour, giving them 49 meals; on the second day, thirty, taking care that the leaves be scattered over them a little thicker; on the third day give them twenty meals, also thicker. At this time let the room be kept very warm and dark; generally speaking, the young worms should be kept in a dark place: during torpor they must also be kept in the dark; but when about to fall into a torpor or when about to awake, they should have a little light; and when about to eat, let in the light altogether. This rule should be remembered.

The same work gives a rule for separating the young black worms as follows; on the 3d day, about ten or twelve before noon, place three hurdles on a separate stand; remove some portion of the heating matter that comes from the worms, lightly lift them over with the leaves, and with a gentle hand put them asunder, about a quarter of an inch apart; thus disposing them in the middle hurdle until it be full; then gradually increase the amount of leaves on feeding them. Should the day be fine you can roll up the blinds of the eastern windows, to admit the morn-

ing ray; also open the windows that are towards the sun, but not towards the wind. Let this be a constant rule; should the sky be overcast, whether in the morning or evening, the windows should not be opened; and at night they must be close shut; no windows or blinds facing the wind or towards the west should be opened: because silk-worms dread the wind; and although after their great torpor they need to be kept cool, yet they must be kept out of a strong wind. When the silk-worms gradually change colour, increase or diminish the quantity of food accordingly. When they have become of a purely yellow colour, do not feed them; this is their first torpor: and no matter whether in the morning or in the evening, they must be removed.

The same work gives directions as to removing the worms on occasion of their first torpor; at which time the worms contract their mouths, and will not eat; they also moult their skins, and undergo a great change. Then you should spread four hurdles on a separate stand; the upper and lower ones are to screen off the dust and damp; the two middle ones are for the worms, which must be provided with pallets, as before described. Remove the litter, gently lift the silk-worms, and place them at about half an inch distance from each other, thus filling up the two middle hurdles. When they first revive in the course of each hour give them three meals for the first day; on the next day increase the quantity of leaves and roll up half the blinds. When they begin to turn yellow again let the worms be kept very warm; when they have fallen into a torpor, they must still be kept warm; and when they have all awaked let them be a little warm. In removing them after the first torpor give them plenty to eat, and set them about half an inch apart, disposing them over three hurdles.

The same work goes on to describe what is to be done with regard to removing the worms at the period of the second torpor; and directs that they should be put asunder, each occupying the space of about three fourths of an inch, by which means they will fill six hurdles; when they have all revived, at their first meal the leaves should be thinly spread at the rate of two meals an

hour. The next day you may gradually increase the amount of leaves : and perhaps roll up all the window blinds (with the exception of those facing the wind.) When the worms begin again to assume a yellow colour, they should be kept warm ; when they have all fallen into a torpor, they should be kept rather warm ; and after they have all revived, but slightly warm. When you remove them at the period of the second torpor let them be well fed. At this time the worms may be moved about or put down with the hand ; they do not need (as the little worms did) to have the leaves lifted up to which the worms are attached in order to remove them. Still you must not throw them about, nor toss them from place to place lest you should injure them. The same number of worms will now occupy twelve hurdles.

The Woo-pun sin shoo describes what is to be done as regards removing the worms at the period of the great torpor ; the heating matter that passes from them should be frequently removed, and the worms as constantly fed. Should the south-west wind get up, let down the blinds of the doors and windows. At this period it will not be necessary to remove them by lifting the leaves, but you can handle the worms, and spread them on the hurdles, each at a finger's breadth from the other; you may also take the green pulse, which you stored up in the winter months, and steeping it in water until it begins to vegetate a little, dry it and grind it into a fine powder ; at the fourth meal after their revival give this to the worms mixed up with the leaves, in equal quantities ; this is to cure the worms of the feverish heat which they get into. The silk will in consequence be the more plentiful, and the more easily reeled, stronger and of a better colour. It will be well at this time, to cover in the wooden pent-house to the south of the silk-worm room, under the eaves, to be ready for bushing.

The Sze-nung-peih-yung gives directions about removing the silk-worms after the great torpor, at which time they must be put at a distance of an inch and a half from each other, filling up about five and twenty hurdles. When they are all aroused together, give them their food, every two hours give them three meals : at the first meal, the leaves should be thinly spread, just enough to

cover the white bottom of the hurdle: at the second meal still more thinly, not enough to cover all the bottom: but let the third meal be like the first meal. On the second day, gradually increase the leaves and open all the windows and sky-lights. If it be very warm, tear off all the paper from the windows, but not unless the weather be oppressively hot. When they begin to turn yellow again, let the place be kept a little warm; when they have fallen into their torpor, the warmth must be increased; when they are all waked up together, keep them cool, and put them upon their pallets; at this time they may be disposed upon thirty hurdles. When they have fully commenced eating again, after every meal, take a basketful of leaves, and go round from stand to stand; and if you observe any part of the hurdles void of leaves, then scatter a few leaves over them, to fill up the vacant spaces. Remember, that after the great torpor, when the silk-worms begin to eat again, for every proportion of leaves that is diminished, there will be a corresponding decrease of silk; thus when you perceive a part of the hurdle bare of leaves occasioned by the silk-worms having eaten all the leaves there, you should immediately fill it up: otherwise you will have a number of thin cocoons. Mix also some rice-flour with their food. After the seventh or eighth meal, at about ten or twelve in the forenoon, take the leaves which you have shred, and scatter them over the hurdles. A celebrated silk-worm rearer remarks here, that after the great torpor, it is still necessary to shred the leaves; people in the present day do not do this: he does not know, he says, whether people in the north do this or not: it is also a question with him, whether those who neglect to shred the leaves, do not incur some loss by their neglect. The work above quoted goes on to say, Take some fresh water, and sprinkle it in a very even manner over the leaves; then wait a little time, and take some finely-sifted white flour, and scatter this also over the leaves; for every basket of leaves use a pint of water, and four ounces of flour. Each basket of leaves will be sufficient for one hurdle. Then mix up some dry powdered mulberry-leaves, in order to make the silk-worms fat, the cocoons large and heavy, and the silk firm and strong; after having shred

the leaves, sprinkle evenly some fresh water on them, together with these dry powdered mulberry-leaves, well sifted; three or four meals of which may be given at intervals after the great torpor. The removal of the litter may be effected after the great torpor, during the eleventh or twelfth meal. When the silk-worms are about coming to maturity, give them their food very fine and thin, but very frequent.

The same care must be bestowed on feeding the old as the young silk-worms; just as with men when they are old, too much food would be injurious. If you are not careful in this particular, the worms will not be clean in their eating, and the refuse leaves will generate damp; the worms will also take leaves with them into the bush, which will make the cocoons they form damp, as if they had been wet with salt water. This is called the bush dampness; the cocoons when affected thereby are difficult to wind off. They must also be kept a little warm.

Han-she, in his Plain Account, says, After the great torpor, silk-worms require only fifteen or sixteen meals, before they arrive at maturity; and the amount of silk to be obtained from them altogether depends upon these few days; when they are approaching maturity, deal with them according to the plan for regulating the food after the first torpor. Wait until nine tenths of the worms are mature, when you can remove the worms from the hurdle to the bush, by which means you can prevent the evils arising from heat and steam in the bush; the worms will also form their cocoons the earlier, and produce the greater quantity of silk.

The plain Account of mulberries and silk-worms, says, The worms which pass through four periods of torpor are a different species, but must be dealt with according to the method observed in rearing the spring silk-worms; only at the third torpor, you have to remove them into fifteen hurdles, after they have eaten to the full, into twenty hurdles; and after the great torpor, into thirty hurdles.

Hwang-sang-tsang says, that silk-worms from the time of hatching pass through three periods of torpor; on each one of which occasions they should have shred leaves given to them. On removing them and changing their hurdles, you should sprin-

kle the latter with the dust of the chaff-basket, and then the worms will feel themselves at ease, and escape sickness. Some persons make use of a net in order to remove the worms. In rearing the warm weather silk-worms diligence is necessary and the leaves should be renewed as soon as they are consumed, lest the worms through hunger suck in the hot air, and become sick. In removing them from their hurdles, you should do it when the leaves are but half consumed, then you will spare your own labour, and not annoy the worms. When they are aroused from their third torpor put a pound of them in one basket, from which you may afterwards obtain eight pounds weight of cocoons; these will produce a hank of silk weighing sixteen ounces. When the worms are first hatched, scatter over them some fire-dried loose leaves, that have been rubbed and bruised; the little worms on perceiving the fragrance will ascend when you can take up the leaves and put them on the hurdle. The stove should be supplied with ignited balls of charcoal, the heat of which must be repressed by lime and covered over with a tile, so as to produce a gentle heat. Place a cotton coverlet thereon, and afterwards remove the coverlet on to the silk-worm hurdle; should the worms be either scorched or famished in the one case they will become yellow with heat, and in the other they will die of hunger. Let not the leaves be given to them in a damp state, for if so, they will pass a white liquid and die. Hence, should the leaves be gathered during a shower, they must be wiped, or dried in the air.

The same writer says, The bushes may be made of rice-straw, which must be cleared of the extraneous leaves, which would otherwise drag the silk. Handfuls of this straw must be bound together for bushes; and the extraneous leaves which have been stripped off should be thickly spread underneath, as a kind of mat, for the sake of warding off the dampness of the ground, and in order to receive the worms should they fall down. Then take a handful or more of the worms and put them on the bush, but do not cover them with paper. The next day, scatter a little more rice-straw about the bushes, to assist the worms in fixing their yet unsettled hold. Do not employ baskets that have been used for holding vegetables to lift them up with; if you annoy the

worms too much the cocoons will be thin. In seven days the cocoons will be spun, and in a fortnight the moths will be produced. When the silk-worms are of a greenish colour, they are approaching maturity. Should it thunder whilst the worms are on the bush, cover them with paper, to quiet them.

Those cocoons which are long, and of a shining white, produce the finer silk; while those which are large and of a greenish colour, produce the coarser silk. After stripping off the coarse floss from the cocoons, those which appear rumpled and rather damp are called dark cocoons; those in which the silk is thin and mixed are denominated floss cocoons, the silk produced from which is coarse; do not let these remain more than a day without reeling; lest the silk become rotten and hard to reel. Further, you must not burn incense near them; for if you do, the chrysalides will form indentations in the cocoons and it will also be difficult to reel them. The larger sort of cocoons are called coarse workers, or *cocalons*.

If you have not time to reel off the cocoons, put them up in a jar well-plastered over with earth; for every large jar, use four ounces of salt, wrap the cocoons up in the leaves of the nelumbium, and stop up the mouth of the jar with the same. In seven days the moths thus treated will die; when you have plastered up your jars, you should frequently inspect them for if there be the least crack in the cement, the moths will remain alive.

The payment for drawing out or carding the floss silk, or the silk of those cocoons which cannot be reeled (literally the silky cotton), is the hundredth part of a tael of silver (or one penny) for every ounce. Of this carded silk the gno k'how, moth-eaten kinds, is the best; the shang gnan, come-ashore kind next; the hwang keen, yellow cocoons, or balls containing the chrysalides, follow next in order; and the keene, or outer floss, is the most inferior. The moth-eaten kind are the perforated cocoons; the come-ashore kind are those from which the ends cannot be obtained in reeling, which must therefore be dragged out of the pán; the outer floss is the coarse floss which the silk-worm spins before it begins to form the cocoon.

Silk-worms must not be brought in contact with the fumes of the frying-pan, nor with the smell of coal; you must not burn incense near them, nor carry scents about you, when you approach them; for they cannot bear the smallest particle of odour: if you fail to observe this caution, the worms will become yellow as if scorched, and die. Strange persons must not enter the apartment; lest the worms should begin to wander, and not remain contented on the hurdles. Let not any one eat ginger in the silk-worm apartment, nor broad beans. Of silk-worm rearers, the inhabitants of How-kaou are the best: you may reckon their remuneration by the baskets of leaves; for every 20 baskets they bring, give them a tael of silver, about eight shillings. Of silk reelers, the people of Nan-tsin are the best; the wages of these may be reckoned by the day; for every day, give them four hundredths of a tael of silver (about four pence); or you may give them six hundredths of a tael (about six pence) for every reel of silk they wind. If the silk-worms are not warmed by fire, when they are put on the bush, the reeling of the silk will not be clean. The women who attend to the silk-worms must not handle bitter lettuce, for if they do, the worms will become green and rotten; those who eat bitter lettuce, also, must not enter the silk-worm chamber.

Han-she, in his Plain Directions says, Early silk-worms arrive speedily at maturity, are subjected to fewer sicknesses, consume a smaller quantity of leaves, and produce the more silk. By this means, not only may the present year's crop of silk be well-secured, but the growth of the next year's mulberries be promoted. The early silk-worms are hatched about the 22d of April, and arrive at maturity in twenty three or four days. About this time the mulberry-leaves are just springing forth, and the juices of the trees ascending: thus the leaves and twigs, after having been clipped, will have time before mid-summer to grow for a month or more, when they will become more luxuriant than in the preceding year; so that by the spring of the next year, the leaves will have come out a little sooner than usual. Going on thus, from year to year, the mulberries will flourish exceedingly, and all in consequence of the early hatching of the silk-worms.

On the other hand, the late silk-worms are longer in coming to maturity, are subjected to many sicknesses, consume a larger quantity of leaves, and produce less silk. By this means, not only is the present year's produce delayed, but the next year's crop of mulberry-leaves is injured. People in general only think about coveting much, to increase their gains, and do not consider that to expedite the hatching will produce a still greater gain. Thus they keep back the hatching of the eggs, until the mulberry leaves are abundant; but the hatching of the worms being later, the budding of the next year's mulberry-leaves will be later also.

The Woo pun-sin-shoo says, There are ten states of the silk-worm to be observed, in order to regulate their food: viz. cold, heat, hunger, fulness, separation, closeness, sleeping, waking, speed, and slowness.

The Silk-worm Classic says, Silk-worms have three kinds of brightness; the white brightness, when they are about to eat; the green brightness, when they are satisfied, (for a shrivelled skin is with them indicative of hunger); and the yellow brightness, when they are about to leave off eating,

Han-she again says, There are eight things proper for silk-worms; when about to fall into their torpor, they should be kept in the dark: after they are aroused, they should be put in the light; when the worms are small, and when they are near the time of torpor, they should be kept warm and dark; when the worms are large, and after they are aroused, they shoutd be kept light and cool: when about to cat they should be well-ventilated: at this time also the leaves should be given to them plentifully and quickly. When they are newly aroused, the worms are afraid of wind, and at this time they should have the leaves thinly scattered over them and be fed slowly. It is necessary to know these requisites for the silk-worms because treatment of an opposite kind will be very improper, and the worms if exposed to it will not come to perfection.

There are three occasions on which the worms should be kept,

wide apart; when they are hatched; when they are put on the hurdles; and when they enter the bush.

There are five things of which the worms must have an abundance; viz. plenty of attendants, and plenty of leaves, wide apartments, large hurdles, and numerous bushes.

The Woo-pun-sin-shoo says, The things which the silk-worms dread are the following: When they are fed they abhor damp and hot leaves: when they are first hatched, they dislike the dust raised by sweeping the floor; they abhor the smell of frying fish or flesh; also the smoke of a paper match, when half extinguished, in the silk-worm apartment; they do not like to be near the noise of pounding or beating or of a tapping at the doors and window-frames, stands and hurdles, or indeed any kind of noise; they cannot bear the sound of crying and weeping in the room: also filthy and wanton conversation!! At night, you must not allow the light of a lamb or candle suddenly to dart through the crevices of the windows of the house; women who have lately been confined should not undertake the care of the silk-worm; the persons who attend upon the worms should not frequently change their dress, but they should keep their hands constantly clean; people who carry about wine should not be allowed to bring leaves for the worms nor to shift and remove the silk-worms. From the time of hatching until maturity, silk-worms very much dislike smoke. You should not lay knives about the stoves or hurdles. In front of the stoves take care that there be no hot water boiling over to stir up the ashes. Persons in mourning should not enter the house! Let no leather nor hair be burnt near them. Silk-worms also dislike wine, vinegar and all kinds of strong tastes, the smell of raw meat or fish musk. &c. They do not like to be put before a window into which the sun shines, or the wind blows; likewise they dread the western sun, with extreme heat violent winds, and severe cold. So also they must not be removed from a state of cold, to sudden warmth. Dirty people must not come into the house where they are, and the silk-worm apartment should be kept free from filth.

The place where the silk-worms are bushed, if outside, should be high and level ground; if inside, there should be a free circulation of air. Let the bushes or brushwood be equally distributed and let the worms be placed rather wide apart from each other, lest they should be affected by the heat; in which case, they will experience some difficulty in forming their cocoons, and the silk which they spin will be reeled with difficulty. The bushes should not be arranged on a north-eastern elevation, nor in a place where domestic animals are bred, nor under the shade of trees, nor in the vicinity of a dung-pit or any filthy drain.

The Sze-nung-peih-yung says. The main thing to be attended to in bushing is, keeping them dry and warm, and avoiding cold and damp. There are six evils to which the worms are exposed during bushing; 1st, the bush sweat; 2d, falling off the bush; 3d, wandering about; 4th, the chrysalides turning red; 5th, turning pale; 6th, assuming a dark hue. The bush sweat arises from the worms being fed with dirty leaves, when they come to maturity; these leaves generate dampness and when the worms take them into the bush, they also become damp and soft, which is called the bush sweat. The other five evils are caused by damp ground, and cold weather. When the silk-worms are approaching maturity, if they are to be bushed outside, prepare the ground for bushing; kindle a fire on the ground, in order to dry it well, and after sweeping away the ashes, bush them there. This is the practice pursued in the north: in the southern regions, however, as the rainy season sets in about the time, it is very difficult to bush the worms outside, hence they must be bushed in a house, which must be made warm with fire.

Han-she, in his Plain Directions, says, In outside bushing, you should form a round bush on a stand in some elevated position: one bush will hold about six hurdles full of worms. When the worms are nine-tenths arrived at maturity, scatter the leaves thinly over them, and remove them from the hurdle with a sieve; then with a gentle hand scatter the worms on the bush; they should be distributed equally and rather wide apart; cover them over lightly with some twigs or coarse grass; bean-stalks will do; and

again scatter some more worms on as before. When you get to the third hurdle, put on the brushwood with the roots uppermost, which will render the bush round ; and firm. After this, you must scatter the worms nearer the top of the bush; and when six hurdles full of worms have been thus scattered on the bush, cover the whole over with southern-wood twigs, and form the top of the bush round ; put hurdles on the top all round, and mats over these, until the top of the bushes is like a little dome, so as to ward off the rain. In the evening use more mats, which you can wind round the bush, from the bottom to the top, with the mats joining on to each other. When the sun is high, remove these, and at night replace them ; after three days, when the cocoons are formed, the mats will be no longer necessary. The pier-head bush must be surrounded by matting, as above described, only the brush-wood should be more roomily disposed, with open spaces, supported in the centre by posts. These pier-head bushes should be employed when the worms are numerous. The mode of sunning the bush is as follows : on the third day after the worms have been put on, from eight to ten in the morning, remove the mats, and let the sun shine on them, but at two o'clock cover the bush with matting as before. Should the day be too warm, let a thin mat remain over the bush to screen it. As to turning the bush, it may be observed, that when the worms become wet with rain after having been put on the bush, as soon as the rain is over, select a new place for the bush, and whether they have formed the cocoons or not, turn and transfer the bush to the new place; after which, cover it with matting as before. This is not necessary after a slight shower, but the bushes must even then be exposed to the sun.

Another plan is, when rainy weather prevails at the time of bushing, to set up your bushes in the silk-worm apartment, upon the floor underneath your frames, but open your doors and windows, to allow of a free circulation of air. In the mornings and evenings, however, or when it is cold in consequence of the rain, you should close the doors and windows, and make a fire of cow-dung ; this method will be better than turning the bushes over as above described. Another method is lightly to scatter over the frames and hurdles some brush-wood, or coarse grass, and surround these

with matting, when the worms will form their cocoons of their own accord, which will be better than bushing them in the rain.

The Woo-pun-sin-shoo says, The cocoons when formed may be taken up with both hands, and spread out thinly in a cool place; which will delay the moths in coming out, and obviate the necessity of hurry in the reeling.

The Sze-nung peih-yung says. The great secret of reeling off the silk consists in having it fine, round, even, and of proper tension; and in preventing its being flat, wasty, knibby, foul, coarse and uneven. It is better to reel the cocoons while the worms are alive; but if you have not time, you can kill the worms and reel at your leisure. There are three modes of killing the worms; 1st, by drying them in the sun; secondly, by soaking them in salt; thirdly, by steaming them. The latter is the best; many unskilful persons, whilst drying them in the sun injure the cocoons; on which account, it is the safer way to steep them in salt water. In reeling the cocoons, hot boilers may be employed for coarse silk, with single or double threads; but cool pans are the best for bringing off the silk clean and glossy. The boiler should be large, placed upon the fire-place, and upon the boiler a large pan, with a mouth narrowing towards the top: water must be put into this, till it is rather more than three parts full; across the jar put a piece of board to divide it in two, in order that two persons may wind off opposite to each other; when the cocoons are few, a smaller pan may be used. The water must be hot, so that the cocoons may whirl round by the force of the heat, with a tendency to sink towards the bottom: if they descend too much, however, you will not be able to reel off fast enough, and the cocoons will be boiled to pieces. By employing a cold pan, you may reel off complete threads, and if you have fine silk, and middling-sized cocoons, you can reel off double threads, and produce the silk of a more natural appearance and firmer texture. Although we call the pan cold, however, the water should be tepid; the jar must be large, plastered on the outside, the mouth should be about two feet and a half in diameter or more. The jar must first be invert-

ed and plastered with adhesive clay from the bottom and all round up to the top, about four finger-breadths in thickness gradually thinning, however, towards the mouth of the jar, which must be dried in the sun, and is then called a double jar. When used, it must be filled with water eight or nine-tenths full, which water must be kept tepid, and not be made suddenly hot nor suddenly cold. When a small pan is used, the mouth may be about a foot in diameter, or even less; if it be small, you of course put in fewer cocoons, which must be put in the oftener; if too many at one time, they will be overboiled and irregular. The stove on which this is placed, should be an upright furnace, made of half-round unburnt bricks, built up like a pillar, hollow in the centre like a pipe: the height of it should be about one half that of the person reeling the silk; the circumference and diameter of the furnace must be according to the size of the pan about to be employed. In the middle of it, construct a small stand the diameter of which should be a little larger than the bottom of the pan; place the double jar upon this small stand, so that the jar come out a little higher than the top of the round furnace. Near the round furnace, place the small stone for the pan in which you put the cocoons when you seek for the ends of the silk threads; this should be about one-half as high as the round furnace. Let a flue be made through the round furnace; and opposite the flue, near the top of the round stone, open out a hole for a chimney; this chimney should first consist of a horizontal pipe, seven or eight feet long. Before this pipe is fitted in, however, make a stand, a little lower than the mouth of the pipe; and at a distance of seven or eight feet from it, construct another stand, five feet high, then take a couple of beams about ten feet long, and place them in a slanting position upon these two stands; let the two beams be a little more than the thickness of a brick distant from each other, and then with bricks, and plaster construct your horizontal chimney. For this purpose, you must lay down a row of flat bricks, then a row of upright ones on either side, with another flat row on the top as a covering; and the whole being well plastered, your horizontal chimney is formed. This chimney must be opposite to the mouth of the furnace; if for instance the

mouth of the furnace face the south, the opening for the chimney must be towards the north. Let the pan for reeling the silk be placed in the middle of the furnace; let the fire rush under the bottom of the pan and the stand on which it is placed; the smoke and flame having encircled the pan, will pass out at the horizontal chimney; thus the water in the pan will be kept constantly warm, and of an even temperature. The smoke and flame will also be removed to a distance from the jar out of which the silk is reeled and the reeler, not being incommoded by the fire, will be enabled to pursue his occupation in comfort.

The winding-bench should be of the same height as the pan, with a spindle two feet long, four inches diameter in the centre, and three at each end. This spindle may either be four-square, or hexagon; the arms or spokes of the reel should be a foot and a half long. The hexagonal form is not so good as the square one, for the fewer the sides of the reel, the easier will it be to disengage the silk when wound on to it. The arms or spokes may be single, or made with hinges to fold in the middle; the latter mode is preferable. There must be a foot-board to turn the reel with. The bamboo tube of the reel should be small, with an iron spindle passing through the tube; the two upright pins in which it turns, should be iron also. Put the iron spindle through these two pins, after having inserted it in the tube: thus the working of it will be light and easy: otherwise you will not be able to get your silk off in good style. As the ancients say, When a man wants to perfect his work, he must first adjust his tools.

The plan for getting hold of the threads of the cocoons is as follows; put some water into the small pan near the furnace, until it is about nine-tenths full; burn under the furnace some coarse dry wood, and when the water is very warm, throw some cocoons into it. Put in but a few cocoons, however, lest they should be overboiled, and the silk obtained be small in quantity. Stir these about gently with a skewer, that the cocoons may revolve, and move about equally. Then try to get hold of some of the ends of the silk threads, and hold them near the surface of the water, jerking them slightly several times; after this,

take up the loose ends of the threads, and disengage them; all below this will be found to be fine silk. When people perform this operation roughly, or wind the ends of the threads several times round a stick, they sometimes take off several feet of thread, which will considerably lessen the amount of good silk to be obtained from each cocoon. If, however, the ends of the threads are gently taken up, one foot only need be wasted. Take hold with one hand of the fine silk threads, and with the other, using a perforated ladle, slowly press the cocoons into the hot water; then take the ends of the threads thus cleared, and suspend them to the silk pin fixed on the outside rim of the pan.

With regard to reeling the silk we may observe, first get about fifteen of the silk threads thus cleared and suspended to the silk pin. (In the case of yellow silk, which is rather coarser, the number of cocoons which you reel off at one time may be diminished.) Bring all these together, and put them through the hole of a copper cash;* then fasten them on to the reel; two windings on the upper rail of the reel, and two on the lower rail of the reel, thus fastening them on the winding machine. Then take some more fine threads from the silk pin, and attach them to the reel as just now described. Should there be two silk-circles, or collections of cocoons in the middle of the pan, the heads of each should be equal. Having arranged all the above, press the foot-board with your right foot, and turn the reel to the right, constantly watching the pan carefully, and keeping both the silk-circles distinct. Should the silk of any of the cocoons therein be wound off before the others, and the chrysalides have sunk down, or should the silk of any of the cocoons be severed, and the cocoons swum out of the silk-circle, the cocoons in the silk-circle being thus diminished, you should take some new threads that have been already cleared and join them on in proportion, taking care that the lines of silk threads coming from each of the silk-circles be always equal in size. It is necessary to keep the eye constantly on the watch, and the hand perpetually busy in arranging and adding

* Underneath the copper cash, the part of the pan where the cocoons are collected together, is called the silk-circle, or the silk dish,

more threads; but do not add more than three or four threads at a time; should you fail in adding new threads the line will become too fine; and if too many, coarse. If your hand cannot join on the threads in time, tread the foot-board a little slower, and the silk will become thicker; but should you have added too many threads, then tread the foot-board a little more briskly, and the silk thread will become smaller; thus the hand and foot must correspond to each other, and the silk will be even. Some say, however, that the quickness and slowness of the winding has no effect upon the size of the thread.

If in adding fresh threads, you join them on far above the silk-circle in the pan, you will make the junction apparent; but if you take the new ends of the threads which have been already cleared, and with the end of your finger, feed them on to the line just coming from the silk-circle, they will of their own accord be drawn up, and the junction will not be seen. This kind is called the complete thread, which being plump, fast-spun, and without knots, is reckoned of the superior kind. It is good for weaving gauzes and laws, with the best sort of silk goods. That kind which is reeled with two threads upon the rails, is called the double-threaded silk; this not being very plump and fast-spun, and having some knotty excrescences, is reckoned of the middling kind; it cannot be used for gauzes and laws, but may be employed for the middling sort of silk stuffs. That kind which is reeled with only one thread upon the rail, is called single-threaded silk, and mouth-rest silk: this being flat and loosely spun, with large knotty excrescences, is not capable of being employed for silk piece-goods, but only for lute-strings: this latter is not considered strong; and its abounding is to be ascribed to the winding off out of hot pans. Heuen-hoo, a southern writer, remarks on this subject, that the silk-reelers of the present day, always reel with double threads, and do not use a bent rail; the more renowned silk cultivators, such as the Tsin and Wang families, make no distinction between complete, double, and single threads; for the ancient plan has long ago fallen into disuse. Finding it mentioned in the books, we have merely copied it,

according to the old statements, but we have not seen this mode of reeling practised in the north, and do not know what this bent rail means.

Heuen-hoo observes, that in his opinion, there should be a pair of cold pans joined together; for boilers, earthern or copper pans should be employed instead of iron ones; because the silk, when wound off out of the former, is brighter and more glossy, than when wound off out of the latter. There should be one boiler expressly for boiling the water, in which the ends of the silk threads are taken up. Thus, there should be two boilers and two cold pans connected together, and two silk-reeling machines. Five people may then work at the same time; two at the pans, two at the boilers, and one attending to the fire. The smoke and fire being made to pass through the horizontal chimney, in order to heat the connected pans: let one person attend to the fire, which is under both boilers; let there be a drain to drain off the water from the two pans, provided with a valve to open and shut, as may be necessary. Two persons may watch the boilers, in order to get hold of the ends of the thread from the cocoons, and let two attend to the pans, to manage the reeling. Thus five persons working together may wind off thirty catties of silk; which would be better than having two persons with one reel and one furnace, who would wind off only ten catties; for by the former means, five people would be able to accomplish the work of six persons; and the fuel of one furnace would be less than that required for three.

Han-she, in his Plain Statement, says, When the cocoons formed by the silk-worms are hard, and the thread reeled from them is coarse, needing to be reeled quick, then the cocoons should be steamed. But when reeling from cold pans, the cocoons are thin, giving forth too small a thread, so as to necessitate the reeling slowly, in such case, your cocoons should not be steamed, but merely reeled out of hot pans. The method of steaming is as follows: Take three tiers of round flat baskets, and having wound some soft grass round the mouth of the boiler, put the two tiers thereon. It is no matter whether the baskets be large or

small. Spread a qtantity of cocoons equally throughout each basket, to about the thickness of three or four fingers. Frequently try with the back of your hand upon the top of the cocoons ; and if they are become so hot, that you cannot keep your hand there, then take away the lower basket, and put another fresh basket on the top. Take care that you do not steam them too much, for if you do, the ends of the silk threads will become soft. So also, it is necessary, that they be steamed enough, otherwise the chrysalides will perforate the cocoons. But if the heat be just such as the back of the hand will bear, it will do very well. Put the cocoons after they have been steamed upon the hurdles, arranged on stands in the silk-worm room ; take the cocoons which are uppermost in the first basket, and with your hand gently move and spread them about : when the first hurdle is filled with cocoons, put it up, and spread another hurdle full. When they are cold, cover them over slightly with small willow twigs. The cocoons must all be steamed on the same day, if they are not all steamed thoroughly, the next day the chrysalides will perforate them. Having done all this, proceed to reel your silk, and if you can wind off a whole batch in one month, it may be considered expeditious. Put about an ounce of salt into the hot water pan, with half an ounce of oil, and then the ends of the threads on the cocoons that are steamed will not become dry.

The Woo-pun-sin-shoo says, In rearing summer silk-worms it will be better only to rear a very few, for the sake of getting eggs for the autumn brood ; if you rear more, it is to be feared the new shoots of the mulberries will be injured, and thus the leaves for the spring silk-worms of the next year will fail. People of the present day, in rearing silk-worms in the hot season, paste their window trellises with paper, in order to keep out the flies, and prevent the wind from blowing backwards and forwards through the apartment. In very fine weather, the worms are subject to disease from the heat, and in very rainy weather the dampness produces in them the white sickness ; so that both very fair and very foul weather are alike inconvenient. It will be better, therefore to paste gauze over the trellises of the windows, and to spread rice-straw about, as pal-

lets for the worms. The method to be adopted for pasting gauze on the windows, is to paste some slips of paper half over the edges of the gauze, and the other half on the sides of the windows; tie some strings across the windows to support the gauze in the middle; and when the silk-worm season is over, the paper may be moistened with a little water, and the gauze taken down, to be kept for use next year. It is well also to use hanging screens made of reeds. All the windows should be fastened by ties and not plastered,- thus the entrance of flies will be avoided, while a free passage for the air will be afforded, if necessary. The silk worms must be reared in a separate room, where strangers do not come and go. The leaves may be shred by means of scissors; the worms must be removed and separated morning and evening, and they must be fed frequently by night.

With regard to autumn worms, it may be observed, that when they are first hatched, it being near the dog-days, and still very hot, it is likely that the silk worm apartment would be damp and warm: they should therefore be kept open on all sides, having a thorough ventilation of air. For when these autumn worms are hatched, they need to be kept cool; their pallets must be made of old rice-straw, in preference to wheat-straw. These should be removed once a day; the neglect of which will produce much white sickness. After their first sleep they must be kept warm; and after their second sleep they must be treated as the spring worms are dealt with; the doors and windows being all protected with blinds, and a smokeless smouldering fire kept up in the apartment where they are. After the great torpor, they must be kept altogether warm, and the thing most to be dreaded is the north wind and cold air. The worms must not be fed with leaves damp with rain or dew. The methods to be observed in rearing the spring and autumn worms at the beginning and end of their existence, are exactly the reverse, one of the other: this must be carefully attended to.

The time when these worms are bushed, is deep in the autumn, and it is to be feared that owing to the cold winds at night, the

worms will not be able to form their cocoons ; therefore on the north-west of the bush, it will be well to fix some posts, upon which hurdles may be fastened, in order to keep off the cold north wind. If this be done, after two or three nights, the worms will be able to form their cocoons.

The Sze-nung-peih-yung says, that the summer silk-worms are a distinct species of worms. The common opinion, however, is that these worms are produced at three different periods; that the spring worms lay eggs for those of summer, that the summer worms lay eggs for those which come out in autumn, and that the eggs of the autumn worms produce those of spring : further that the series of these must not be interrupted, lest such interruption should destroy the race. Heuen-hoo says, that according to the common opinion the results of the two latter breeds are extremely small ; but in his establishment, he adds, they have taken the eggs of the spring worms to raise summer worms from them, and have obtained thereby good cocoons. The summer worms, from the time of hatching to maturity, must be kept cool ; they must also be kept free from flies : previous to the hatching of these worms, it would be well to burn some chaff along the foot of the wall of the silk-worm apartment, in order to expel damp and insects ; after the worms are hatched, early every morning, the worms must be removed. With regard to other things, the treatment of these worms is the same as that of the spring worms. It is better, however, not to rear too many of this description, but merely sufficient to provide eggs for the autumn worms ; for if too many be reared the leaves will be exhausted.

The same writer says of the autumn worms, which are also called original worms, that the gathering of leaves for them cannot but be injurious to the trees ; although, should the spring worms turn out unproductive, through bad seasons, and there be no resource left, the autumn worms may then be reared, to make up the deficiency. These must at first be kept cool, and gradually made warmer; just the opposite of what is requisite for the spring worms. At first you must pick the leaves for them, but afterwards you may strip the leaves off the branches ; at first also you may have

gauze pasted on the windows, but as the weather gradually becomes colder, you must paste paper over the windows. The method of bushing and winding for these is the same as for the others. For the purpose of warming these worms it would be well to burn some chaff, and wheat-straw under the stands where the worms are kept. Also get three or four bushels of the dry dust of a well-trodden road, and spread it under the stands, on the day when the worms are hatched, in order to keep off both heat and damp. In bushing the autumn worms, many persons make a dull fire in the middle of the bush, which may sometimes scorch the worms. The best way, however, is to form the bush in some warm and airy place, and spread some wheaten straw equally under the bush. For the bush, you should employ dry mulberry sticks, as a frame-work, and new wheaten straw for a thatch, and availing yourself of the natural heat of the weather, there will be no need of a fire. After a shower of rain, invert the bush. People in the present day do not rear autumn worms, but merely use the eggs of the summer worms to serve for the spring worms of the next year, which will also do. It is a good idea to take the autumn worms to make up for any deficiency of the year's crop, for there is generally much fine weather in autumn, and the season is more settled than that of spring.

ON THE PLANTING OF THE MULBERRY.

According to the Urh-yay dictionary, the mulberry trees are divided into those which do, and those which do not bear mulberries. There is also the female or small mulberry, with long branches; likewise two species of plants, called the E mulberry and the wild mulberry, which resemble the true mulberry, and produce wood good for making bows, or yokes for carriages; and the yen mulberry, with spotted veins, also called the morus papyfera, which when employed in rearing silk-worms, produces silk that is good for strings of musical instruments: besides having a wood which is fit for various purposes.

Wang-ching, treating on planting trees, quotes a work on natural productions, which says, that of the various plants met with among the hills Guan-yih in Shan-se, is one place in a thousand for

its dates; that Yen, in the same province, and Tsin, in Kan-suh province, are equally famous for their chestnuts; that Shuh and Hain, in Sze-chuen province, and Keang-ling, in the province of Hoo-pih, are as much celebrated for their oranges; while Tse and Loo, in the province of Shan-tung, are distinguished for their mulberries. We say of a distinguished individual, that he is one in a thousand; and when this language is used of the productions of a country, it implies that the benefit to be derived from their cultivation is extensive. On looking over the account given of Kwo-to-to, by Lew-tsze-how, we find the latter praising the hero of his story for skill in planting and transplanting trees; asserting that in no instance did he fail, while the trees planted by him not only grow, but brought forth fruit early, and abundantly. Other people striving to imitate, could never come up with him. From which we perceive, that in planting trees, we cannot dispense with method. On examining the Book of Odes, also, we find the following allusion: "The Supreme Ruler observed the hill (where they were settled), and perceiving that the thorns and briers were pulled up, and the firs and larches formed into rows, (knew that the people had resorted thither in great numbers);" from which originated the decree in favour of the Chow dynasty. So also, in another part of the Book of Odes, we read, "They planted the new region with filberts and chestnuts, with dryandria cordifolia, the varnish tree, and such like;" upon which occasion, it was that the Lord of Wei established his kingdom. Seeing then that kings and lords, rich and noble though they were, still considered it a meritorius thing to plant trees, how much more should the common people. According to the Chow-le, the prime minister in assigning the nine kinds of duties to the people, first spoke of the three classes of cultivators, raising the nine species of grain; and then turning their attention to the matter of laying out parks and gardens, as being only secondary in importance, compared with the business of agriculture; shewing that he highly esteemed the most essential things belonging to the affairs of the people. Bearing this in mind, can we allow ourselves to be remiss in the matter of planting trees? There are various kinds of trees to be planted, however, which are of great use to the people, but none so im-

portant as the mulberry: we will therefore make this the principal subject of our discourse.

Wang-ching then goes on to say, There are various species of mulberries, which cannot all be enumerated; the most celebrated are the King and the Loo, or the southern and northern varities. The southern mulberry, (or morus nigra) abounds in fruit; the northern (or morus alba) bears little fruit. The leaves of the morus nigra are thin and lanceolated, with serrated edges; those which have the stems, branches, and leaves firm and strong, belong also to the nigra species. The leaves of the morus alba are round, thick, and juicy; those which have flourishing and luxuriant stems, branches, and leaves, belong also to the morus alba, or northern species. The southern or black mulberry, has firm roots and solid wood; this being capable of long endurance, may be planted as a tree. The northern or white mulberry, is neither firm in its roots, nor solid in the texture of its wood, and not being capable of long endurance, may be cultivated as a shrub, or ground mulberry. But the branches and leaves of the southern or black species, are not so luxuriant as those of the northern or white mulberry; the northern may therefore be grafted into the southern, and thus the double advantage of luxuriance and endurance be secured. When the northern or white mulberry is cultivated as a shrub, and the method of bending down the branches into the ground (in the form of layers) is employed, they may be multiplied to an indefinite extent, and be perpetuated for a long continuance. Silk-worms fed upon the southern or black mulberry, produce strong and tough silk, adapted for the manufacture of crapes and gauzes. Hence the reference in the tribute of Yu (see Shoo-king, page 93), to "the tribute-baskets being stored with the wild mulberry and silk." The mulberry-leaves from the white species, may be used in feeding large or older silk-worms, and those from the black species the smaller.

The Po-wan-luh says, The white mulberry-trees produce less fruit, and they are propagated by layers, or by pressing down the branches into the ground, that they may shoot up into new plants. Should there be any fruit containing seed, however they may be

sown, in a shady place. The leaves from these will be thick and large, from which heavy cocoons may be obtained, yielding double the quantity of silk.

The Tse-min-yaou-shuh says, When the mulberries are ripe, gather the black berries of the northern mulberry, and immediately washing them in water, dry the seeds in the sun; then sow them along the dikes which surround the rice-fields, which part must be frequently weeded and cleansed; in the first month (February) of the next year, transplant your seedlings, about five foot-marks apart. Constantly dig about the roots of these, and plant green and small pulse between the rows. On the second year after planting, be careful not to strip off all the leaves. When the trees are as big as your arm, remove them, in the first month of the year (February), and plant them at the distance of ten foot-marks from each other. Let the rows be rather angular, and not exactly opposite each other. If you wish to propagate from these, in the first or second month after the planting, fasten down some of the branches with hooks to the ground, and when the sprouts from these are several inches high, cover up their roots with some dry earth, and in the first month of the next year cut them off, and plant them elsewhere.

Wang-ching, quoting the Tse-min-yaou-shuh, says, When you wish to sow the seeds, take the ripe mulberry, and cutting off the two ends retain only the middle of the fruit; for the seeds at the two ends are proportionably smaller, and if sown will only produce the chicken mulberry, and the flowery mulberry; but the seeds from the centre of the fruit are hard, and the seedlings produced from these will have hard and strong branches, with thick and juicy leaves. When about to sow these, first cover them over with wood-ashes, the next day wash them in water, to clear them of all their lighter and empty particles; then expose them to the sun, until the traces of the water are just dried off, and they will easily germinate when sown.

The Tse-min-yaou-shuh says, In ploughing a field, for the purpose of planting the mulberry, avoid such spots as are near high trees; delve those parts which the plough cannot reach; extract such

roots as are near the surface of the ground; and manure the soil with the litter of the silk-worms. After fifteen years, the wood of the mulberry-trees will be fit for making bows of, and may be used for clogs. The small fragments and cuttings of the wood will serve for the handles of awls and knives. After twenty years the wood may be used for ox-wagons, or for saddle-trees; when the branches are about three feet long, bind them to stakes, and pin them down to the ground, that they may become crooked like the arch of a bridge, and after ten years they will permanently assume that shape. If you wish to use the wood of the mulberry-tree for bows, you should plant them in mountainous and rocky places, having a northern aspect. In high table land, and up-hill rice-fields, where the soil is thick and the moisture abundant, dig a number of deep pits, in which the mulberry-trees may be planted; the depth of the pits may be about ten or fifteen feet, and when the mulberry-trees shoot up out of these, their branches will be fewer. The stems also will be universally straight, and after ten years' growth may be used for almost any purpose. When the leaves of the morus papyfera are given to the silk-worms, the silk produced therefrom may be used for the strings of musical instruments, and the sounds produced will be clear and sonorous, superior to that resulting from strings made of common silk.

Fan-shing, in his work, thus details the mode of planting the mulberry; in the fifth moon (June) take some of the berries, and put them in water; press them under the water with the hand and wash them well; then take out the seeds and dry them in a shady place. Select a fertile spot of ground about two acres in extent; if it has been fallow for some time, so much the better. Plough this field well, and sow it with about 30 pints of mulberry and millet seeds mixed together. On their both springing up weed them, leaving the mulberry plants at proper distances from, each other. When the millet is ripe gather it, and when the mulberries are equally high with the millet, cut the whole down with a sharp sickle, even with the ground, dry the sticks in the sun, and when the wind is moderate, set fire to the mass, kindling the fire in the quarter from whence the wind blows. The mulberries

will shoot up in the following spring; and every acre of ground thus treated will produce leaves sufficient for feeding eighteen hurdles full of worms. Heuen-hoo says, that if the mulberry-fruit be given to fowls or ducks to eat, and the seeds washed out of their excrements, the plants produced therefrom will be less likely to produce fruit, (but will give forth the more leaves, which is what is desired).

Wang-ching says, that the best time for pruning the young mulberry-trees is the month of January; February not being favourable, and March less so for this operation. Generally speaking the more luxuriant the mulberries are, the more they should be pruned.

The Nung-sang yaou-che, says, In a level ground and moist situation, with a light and fertile soil, both the white and black mulberries will thrive. If the situation, however, be a rising ground with a red and hard soil, it will only be fit for the black species.

The Sze-nung-peih-yung says, The great art in cultivating trees is, to hit upon the proper season, and to suit the plants to the quality of the soil, in every case studying the due medium. As to season, about ten days before or after the vernal equinox, and the middle of November, are the most favourable periods for setting and earthing up plants; the former being the season for plants shooting up, and the latter the time when the sap of trees diffuses itself; plants should therefore be set and earthed up at these two seasons in order to cherish their native energies. This is the plan adopted throughout the region of Ho-nan, and within several hundred miles of it. In other places different seasons are chosen, in conformity with the varying nature of the climate. Generally speaking, however, in the spring season, and during the first cold months of winter, when the weather is mild, and during the forenoon of the day, should the seed have come out, the earth must be turned over a little: but if the weather is stormy, you should mix some warm water with the earth which you add to the plants. In warm weather you should wait until the cool of the evening, for earthing the plants; it would be as well, also, if you had previously

sown some hemp or wheat, at wide distances among the mulberry plants, in order to shade them. Seed sown or plants set in the month of December will not thrive.

The Sze-she-luy-yaou says, In planting mulberries, do not heap up too much earth over them, for in that case they will not grow; when the plants are a foot high, add a layer of manure.

The Woo-pun-sin-shoo says, In the 4th month (May), when you sow the seeds of the mulberry-fruit, dig your trenches from east to west; mix some well-seasoned manure with earth, and rake it up equally together, adding some water: and when the spot is well moistened, sow your mulberry-seed; or you may sow some millet with it. The millet aided by the water, will easily vegetate, and after a time, shade the mulberries from the sun. Or you may previously, along the northern and southern furrows, sow some hemp; in order that the hemp when grown up may afford some shade to the mulberries. When the young seedlings are about two or three inches high, should the weather be dry, water them. If you do not sow millet-seeds among your mulberries, you must construct a low frame-work over them, and cover this with reed mats, which during the day may be opened out, and at night rolled up. After the 24th of August, it will not be necessary to cover them any more. When the month of November is passed by, cut down the mulberry-plants together with the millet, and burn the whole; then spread some manure over the soil, to cover the ashes. Having done thus, when the genial time of spring sets in, the plants will flourish again, and the following year they may be transplanted.

According to another method, you are first to prepare a furrow in a well-cultivated field, and having twisted a grass rope, cut off about a fathom of it, which soak in water until it be soft; flour or rice water would be preferable: leave about three or four inches at each end of the rope free, and along the middle of it, rub equally ten or a dozen juicy berries of the mulberry; then lay the rope in the furrow; let the two ends be heavily pressed down by some earth; and cover the middle part lightly

with soil. At the distance of a foot or two from this, lay down another piece of rope as before; and let this be done all over the field, in rows. Should the weather be long dry, water the seedlings; in November cut down the whole, and burn it, adding some manure; in the winter cover the roots over with snow, and in the spring with manure. About the 6th of April, sweep the whole away; when the rains come down, mark where the plants are too thick, and remove them to parts where they are too scantily sown. This method requires less trouble than the mode of planting them in furrows and removing them afterwards, while it is almost certain of success, and will yield its increase a year or two earlier. When the old trees bear the mulberry-fruit, it is better to sow them in the spring; after which you may construct a fence round the plantation. If you think that the rope system is too troublesome, you may put some mulberry and millet seeds together into a dried calabash, and having sown them, brush over the places where they are sown with a brush, so as to distribute them equally. Or if you are afraid of drought, you may, between the rows of millet, make some equal furrows, and introduce a small rill of water, to irrigate them.

Another method is, in the month of spring, to select a spot of ground well prepared, and having made furrows in it from east to west, to sow some hemp-seeds at equal distances from each other; then take the fruit of the mulberry, mixed up with the litter of the silk-worm, or with some burnt husks of millet, and taking advantage of a previous shower of rain, make some holes with the hoe on the north side of the line of hemp plants, and drop your seed therein. This will be a better plan than constructing a low frame-work over the mulberries, or interspersing the rows with millet: because the hemp grows high and close together, while it admits air and dew to the plants; and although you should sow several acres in this manner, you will not find it a troublesome work.

The Sze-nung-peih-yung says, That the mulberry-seed should be new, and not old. The best way is to sow the seed from fresh berries; those that have been kept over till the next year sometimes fail. When the mulberry-shoots come out, let there be

a space of five or six inches left between them. Water the plants frequently, until after the dog-days, when they will be about three feet high. In the month of October, cut down the plants even with the ground, scatter some straw amongst them, and set fire to the whole; but let not the fire be too great, lest it injure the roots. Then cover the spot over with manure and grass; and when spring sets in, rake all this away, and water the plants. Each plant will send forth three or four shoots, of which you may allow the most promising to remain: as the roots are now thoroughly formed, it will not be necessary to shade the plants, but they must be frequently watered. In autumn, if the plants be of the white mulberry, they will be five or six feet high, and if of the black, three or four. The white species may be transplanted for the purpose of rearing them as ground or shrubby mulberries, but the black variety may be removed into the gardens.

The Woo-pun-sin shoo says, The ground or shrubby mulberry, is derived from the white species. When this variety sends forth its shoots, they must be planted and earthed up according to the usual plan. Select some of the most promising, upon which you may leave four or five branches, hoeing them and adding manure. When the branches are limited in number, and the leaves are not abundant, the fatness of the whole being concentrated in a few leaves, these will certainly become large; and are then called shrub mulberries. The mode of planting them is as follows: after autumn, in some warm and open spot, plough the ground well; put some manure into the furrows, and throwing aside the earth, form a number of trenches. If you have no ox to plough with, you may form your trenches with a spade. A little before or after the vernal equinox, take the mulberry-twigs which you have buried in the December preceding, and selecting some that have buds, cut them off in lengths of six or seven inches, or even a foot, and having made some trenches and supplied them with water, plant your twigs diagonally in the ground; then cover over the earth to about three or four fingers in thickness; if the earth be too thick, it will impede their growth, you should arrange them equally with your hand; to the east, west, and south of each branch, sow half a dozen hemp-seeds. After the

month of June, when the buds and leaves are a little high, add some manure; and then, when they are grown a little more, they become ground-mulberries. Or you may select some of the shorter plants of the black mulberry, and during the autumn, plant them with the ends buried deep, and they will soon come to maturity.

The Sze-nung-peih-yung says, The success attending the cultivation of the ground mulberries, depends upon managing them according to the established method, so that they do not perish for want of water. Before detailing this method, however, we may just remark, that those persons who do not cultivate full-grown mulberry-trees, and only avail themselves of the ground-mulberry, will save themselves a great deal of labour: but those who cultivate both kinds, may, after the tree-mulberries are come to perfection, discontinue the use of the ground-mulberry for some part of the season; but then they must pay the more attention to watering and hoeing the full-grown plants, in order to make them flourish. After the silk-worms have gone through their chief torpor, when the tree-mulberries do not furnish sufficient leaves for the time, then they can make use of ground-mulberries; thus there will be no deficiency until the worms have arrived at their full maturity. The method above alluded to is as follows: Fence in a spot of ground as a garden; then plough or delve the ground within the inclosure thoroughly; within each space of five feet square dig a hole; this would allow of about 1,400 such holes to an acre; let the holes be two feet wide, and as many deep; put three ladlefuls of ripe manure into each hole; having spread this equally over the soil, pour in a bucket of water, and work the whole up to the consistence of mud; then take the white mulberries which you have already planted in the furrows, and dig up each plant, roots and all; above the root, leave about six or seven inches of the stem, and cut off the rest; then singe the part where it has been cut off with a hot iron. For every hole that you have dug, you must thus prepare a separate plant, and then insert its roots into the soft mud, pushing it down till it comes to the bottom of the hole; then raise it up several times, in order to bring all the roots into their proper places; let the top of the plant be about even with the surface of the ground, and then throw in some vegetable mould all round it, till the hole be full; the next day,

you may press this down hard; this is to be done round the circumference of the hole, until the earth in the lower half of it is well pressed down; for if this be neglected, the roots will not come into proper contact with this soil, and the plant will be in danger of falling over and dying away. In the upper part of the hole, you must throw some vegetable mould, very lightly, and only half enough to fill it. The soil near the plant, must not be pressed too heavily, for if it be, the buds will hardly be able to shoot out. Then pile up some loose earth over the top, in the form of an inverted basin, about five or six inches in thickness; all round this make a little channel, which may be filled with water. When the shoots are come up above the ground, four or five fingers high, allow only one or two shoots from each root to remain; which, if well-watered and hoed will in the same year attain the height of five feet. The next year, you may cut off the stem, leaves and all, near the root, to feed the silk-worms. For this purpose, you should use a thick-backed knife, well furnished with steel, wherewith you may be enabled to separate the stem at one cut; should you use a blunt knife, and thus not be able to separate it at once, the end of the stump will be uneven, and the rain dripping down will injure the root. At the place where you cut off the stem, all round each root, several shoots will come out; upon each stump you may leave three or four shoots, and the rest may be cleared away. Every year you may cut down the shoots close to the ground, when the roots will gradually become more vigorous; after which you may leave more and more shoots. The plants of the wild white Mulberry, may also be treated in the same manner. Following the method above detailed, the ground or sapling Mulberries will in three years attain to a flourishing condition; after five years, however, the roots will become intertwined, which will interfere with their growth; it will be better, therefore, in the spring season, to cut off and dig up the interwoven roots, and add a little more earth and manure; or water the plants, should there be no rain and then they will again flourish. After this when you find that the roots are growing large, you may press them down, in order to form layers; and having fenced in a piece of ground, you may go on planting them out in a new garden. These young Mulberry-saplings, after

having been planted three years, and become luxuriant, may be cut down for the silk-worms; on which occasion, you may reserve on each old root, one shoot, which being pressed down, will in another year form a new root that may be planted out in turn. In this way you may propagate your Mulberries ad infinitum. It is to be remembered, however, that the silk produced from the white Mulberry, is deficient in toughness: you should therefore make your account to have some black Mulberry-trees at hand, the leaves of which after the great torpor, you may occasionally give the silk-worms.

Han-she, in his Plain Statement, says, The ground-mulberry should be planted in gardens and near to wells; the weeds should be cleared away, and failing rain they should be watered. When the worms are about to be hatched, the plants should be watered thrice as much, and the leaves will be produced the earlier for it.

Chung-hwa-min says, Mulberries should be planted in February or March, September will also do. The roots should be upright and the soil about them should be firm; they should be well-supplied with manure and water, when they may be expected to grow.

There are two methods of propagating the mulberry; one is to sow the seed of the mulberry-fruit, when the shoots will appear in February or March; another is, to take the tender branches of the mulberry-trees, and bending them to the ground, press them down with some earth, when every bud on the twig, will send forth a shoot; this when about two are three feet long, and having a root, may be cut off with a pair of shears, and planted in the ground; after which it will become a tree. Thus twigs which are pressed down this year, will spring up next year, and the following, without intermission.

Hwang-sang-tsang, in his general account of the mulberry cultivation, says, There is a description of ground-mulberries that comes from Nan-tsin, (a town between Shang-hae and Hoo-chow); and a species of mulberry-saplings, which come from Lin-ping, in the prefecture of Hang-chow. The time when they are generally sold, is the early part of February, and the place at which they are disposed of, is the Keang-tseang bridge, inside the Pih-sin

barrier. The plants are brought in bundles very early in the morning, and arranged to the right and left of the bridge; by noon the sellers disperse. When you wish to plant them, weed the ground well, and manure it. Cut off the twigs for planting them out, (which is called giving them in marriage), leave a foot or more near the root, and bury it deep, with about an inch sticking out of the ground. Add some mould, and raise the place about the plant, in order to let the water run off; smear with ink the part where the twig has been cut off, or cover it with a shell, or give it a layer of wax, or resin and oil, in order to prevent its being injured by the rain. Add manure all round, that the roots may spread on all sides. If you water the plant directly from above, it will be deprived of a portion of its vigour and die. Before it is sprung up, you must not irrigate it with water only, but with water mixed with manure; and after two years its growth will become luxuriant. While it is in the ground, you must hoe it once or twice a month. When the plant is about a foot high, you can supply it with undiluted manure. Irrigate all round the spot where the mulberry is planted, that the water may get to the more lengthened roots. Do not pick the leaves for three years, and then the plants will flourish the better. Take care not to injure the more important branches. If you allow the grass to grow underneath the Mulberry, it will flourish the more: but when the silk-worms come out, and you pick the leaves, you must pick them clean, which you may do with garden shears; but more especially where the branches are thickly twined together, so as to leave the stem free: then the branches will next year be more luxuriant, and the leaves thicker. By clipping the branches every year, the trees will flourish the more. It would be better not to rear the summer silk-worms, for if you do, your Mulberry-branches next year will be slender and the leaves thin. Mulberries should be manured with compost, and with the excrements of the silk-worms; also with the ashes of rice-straw and mud from the bottoms of ditches, in order to enrich the soil where they grow. When mulberries are first planted, they should be manured with water-plants, or with cotton-seeds, by which means the roots will become warm and easily grow. Heuen-hoo says, That the oil-cake obtained from pulse, cotton-seed or hemp-seed,

together with the dung of sheep, cows, horses, and pigs, may also be employed. In the early part of spring, prune the plants, by cutting off the dead branches. Loosen the earth, also, about the roots of those plants which are dwarfish and small, and supply them with earth and manure; for if you neglect this, the leaves will be late in coming out, and thin. In selecting* mulberry-saplings, avoid those with a rough bark, because their leaves will be small and thin. Those which have a white bark, with the knots wide apart, and the buds large, are called the Persimmon-leaved mulberry; the leaves of this species will be large and thick, from which will be produced hard cocoons and abundant silk. Those plants which are tall and white, should be planted on the ridges of high ground, or near the corners of walls and hedge-banks. In the month of June, you may take the berries from these, and after washing them in water, dry them in the sun a little; then sow them in furrows, and when winter sets in, burn the crop on the ground; next year you can separate and transplant them. Those plants which are short and green should be planted in a well-watered spot. In the months of February and March, you may fasten the branches of these down to the ground, and lay some earth upon them; the next year you may cut off these branches and plant them out elsewhere. These mulberries should be manured twice a year. When the ground on which you press down the branches is damp, they will rot; but when it is dry, the roots will shoot out. The method of propagating mulberries by the seed is not so good as that of pressing down the branches just alluded to. The things that are unfavourable to mulberries are such as the following: *the mulberry snails*, the holes of which you must find, and stop up with paint oil, when the snails will die. Or you may use a sedge called poo-moo-tsaou, which when in its prime resembles the leaves of the bamboo. There is also a sort of *leprosy among the mulberry-leaves*, on the occurrence of which, an infusion of the above-named plant may be sprinkled on the trees. At the foot of the mulberry you may plant vegetables, but in the mulberry-garden you must not plant the willow, for if you do, you will be overrun with *the willow caterpillar*, which eats the bark of the mulberry, and deposits its seeds therein.

Trees are generally grafted in the month of March. There are grafts in which the cion is inserted, grafts in which it is split, grafts where the branch is pressed down, and grafts where it is added on; in addition to which, there are the grafts where the mulberry is joined on to other plants; where for instance, the common mulberry is grafted into the paper mulberry when the leaves become thicker and larger; cases where the pear is grafted on to the mulberry, when the fruit is superior; cases where the arbute is also grafted on to the mulberry, when it becomes less sour. In selecting mulberry-saplings you should avoid the fowl's-foot mulberry, the leaves of which are thin, producing thin cocoons and a smaller quantity of silk. The kind called golden mulberry, the leaves of which have a yellow covering, and are wrinkled, should not be chosen, or the trees will soon wither: the silk-worms also will not eat the leaves. Those mulberries which first produce fruit, and afterwards leaves, will have but few leaves, and are consequently not to be preferred. There is a description of wild mulberry silk-worms, which live on the wild mulberry, and form their cocoons early: these are of little worth. The green mulberry-trees without fruit, the leaves of which are not very thick, are better for the early silk-worms. There is a species called the *contemplate-sea mulberry*, the method of cultivating which is the same as the white mulberry; in planting either of these, the furrows must be opened in December; into these manure must be put, and when the shoots have been put in, the furrows are to be filled up with earth: after this, in the months of March, April, June or July, clear the plants of insects, open the furrows and add manure: the filling of them up with earth, however, may be delayed. Another description of mulberry is called *the purple-stem mulberry*, which grows tall and large; the twigs of this kind need not be cut off; the leaves are thick and wide; the time for planting this species is earlier than the others; it may be cultivated near dwelling-houses; it is not necessary to open out furrows for it, or to supply it with manure. But when the plants are young, you may manure them once or twice in the winter, particularly in the month of December.

The Woo-pun-sin-shoo says, On the first or second year after the mulberries have been planted, the sap and juices of the roots and stems are less in proportion; after the vernal equinox, you should dig

holes and transplant your saplings. On the north side of each hole, form a sort of upright bank of earth; at the bottom of the bank on each side, hoe up the earth slantwise; pour into the hole three or four ladlefuls of water; then take the cuttings of the mulberries, and plant them against the bank; let one root be placed at an uniform distance from the other; cover the bank with some earth hard pressed down, three or four inches higher than the ground where the hole was made. Generally speaking, all kinds of plants and trees, when they have been recently put into the ground, must not be agitated and shaken: hence the necessity of these banks, to guard against the north wind, and give to the plants the benefits of the southern sun. People in the present day, on transplanting the young mulberry-saplings, do not see to it that they have a sufficiency of roots, with enough mould upon them; so that, when the saplings have to be carried far, the sun and the wind waste the sap and juices of the plants, and there is some difficulty in getting them to live; or if they do survive, to flourish; and then people go and talk about the unfavourableness of the soil, which is only a stupid error. Henceforth, therefore, when people transplant the young saplings, should the locality be distant, they ought to bind up ten or a dozen young plants into a bundle, plaster some mud on the roots which are already covered over with mould, and bind the whole round with straw, matting, or rushes; they ought also to fill up the interstices of the bundle with mud. They should then arrange them end to end, in the bottom of the cart in which they are to be conveyed, so that the plants be not exposed either to wind or sun; in the middle they should lay down over the saplings some matting or straw to cover them; and having previously prepared and manured the holes at the place where they are to be planted, as soon as the trees arrive, they should water them during the day, and plant them out as before described. Mulberry-saplings are generally planted in the autumn, rather than in the spring, when the trees are transplanted entire. The reason why the autumn is to be preferred to the spring is, that in spring high winds prevail, which shake the trees: moreover, in early spring showers are rare, and the weather becoming gradually warmer, the lateral buds and leaves are with difficulty repressed, hence many of the trees die from over-production. By

cutting off the original stem, however, you may still cause the main body of the tree to shoot up; for mulberries flourish the more under the knife, of which the ground-mulberry is a proof. In the southern regions, they bury the mulberry cuttings in November; but to the north of the Yellow River, climate is rather cold, hence it becomes necessary to deposit the cuttings in the autumn. For this purpose, let the holes be upwards of a foot deep, in which the slips may be placed, leaving them to project one or two fingers above the level of the ground; all the rest may be cut away. After having planted your slips, beat the ground hard around them; cover the part where the plant has been cut off with earth; should the ground be frozen, you may add a little manure over them; after the warmth of spring has set in, manure it again. Place an earthen jar near, in which you may collect rain water, wherewith to water the plants in a season of drought. On the south side of your plants, early in spring, plant some hemp: from the time that the rains set in, the buds and branches, will be luxuriant, and then you may treat your plants as ground-mulberries, or you may cut off the smaller branches, leaving only one or two of the most promising. The next year, they will become trees, when you can press down the lateral branches, in order to propagate them; and thus one tree will produce ten or a dozen; or you can remove the whole plant entire, when every tree will live, and your mulberries be abundant. In the month of November, trees deaden their energies, at which time you can put the buried slips into the ground; in the winter months, the vigour of their roots will be downward in its course, but in the spring it will display itself again, and in the course of the next year, the plant will become taller than the original tree. The transplanting of two-year-old mulberries, should take place during the rains; at which time, if the buds and leaves do not flourish, you may place a piece of hard wood near the body of the tree, and cut off the young plants against it about half a finger from the ground; the sharper the knife is for this purpose the better. Plaster the part where the plant has been cut off with earth, and on the south side thereof, sow five or six grains of millet; after about ten days, the buds and leaves will come forth; in dry weather water them frequently.

After the summer has set in, however, this plan cannot be followed, on account of the heat. Throughout the year, with the exception of mid-winter, when nothing can be transplanted, all other seasons are favourable.

The Nung-sang-yaou-che says, With regard to all newly-planted mulberries, you should observe the proper method of cutting off the twigs, and picking the leaves. When they are first planted, and put forth their shoots, do not pick the leaves which grow upon the long stem in the centre, and pick only the leaves which are upon the side branches. You must take care, however, not to cut and mutilate them that the branches may become plentiful and close, forming a sort of hedge round the centre of the tree, to protect it against cows and other cattle that may feed upon it, and to prevent its being pulled and knocked about. Afterwards, when the central stem is become thicker, you may then cut off the side branches and twigs. When the root has become vigorous and all the sap of the tree has gone up into the central stem, it will grow up into a large tree, robust and flourishing, without any hollowness in the centre.

The Sze-nung-peih-yung says, the great art in planting trees consists in hitting upon the proper time of the year, and in suiting them to the character of the soil, that they may not want what is necessary for their growth. The most suitable time for planting is within ten days of the vernal equinox, either before or after; the month of November also is a good time; because the vernal equinox is the period for the springing up of plants; and November, which is called the expanding month, or the little spring, is the time when plants grow the most. You must therefore adapt your planting to the proper season, in order to promote the growth of their native energies.

The same work also says, Mulberries are easy of growth; with the exception of the month of December, which is unfavourable, every other month of the year will answer for planting them. But you should sow some hemp in your garden, or millet among the young mulberry-shoots, as a shade; by observing

every year whether the beginning of April be fine or rainy, you may prognosticate whether your mulberries will flourish or not.

The method of planting the full-grown mulberry-trees is as follows: Fence in your garden, it may be of whatever size you please; thoroughly plough and dig the ground within the inclosure; in every space of three feet dig a square hole, then take a sapling of the black mulberry, which you have already prepared, and digging out the entire plant, roots and all, set it as already described; but over the spot which you have beaten down even with the ground, throw some earth up to cover the plant, about one or two feet high; make a dike all round, and when the mulberry is about as high as a man, cut off the top branches, when the lateral branches will become long; if you water and attend to the plants properly in the autumn they will become long, and as large as the rafter of a house. In the month of November, or in the following spring, you can transplant them, to form your rows of mulberry-trees. When the wild black mulberry will not grow large, you can remove the roots of it into a garden, and rear it, and the effect will be the same as above described.

The Woo-pun-sin-shoo thus details the method of depressing the branches, in order to propagate by means of layers: in the beginning of April, take some of your best two-years-old saplings, and fastening the whole tree down by pegs, did some furrows in the ground, and lay them in, with the small shoots which are upon the branches appearing above the ground; but the rest of the tree with the roots covered with earth. Dig some little holes for containing water all round; in the dry season, you should frequently water your plants. If you do not take whole plants for this purpose, merely select the lateral branches at the foot of the mulberry, and digging furrows as before, bury them up; in the sixth month you should not cover them up entirely.

The Sze-nung-peih-yung details another plan as follows: When the spring is just putting forth its energies, take a side branch of the ground-mulberry, and bending five or six inches from the top turn it towards the ground. Having first prepared a furrow about five fingers deep, lay the branch down flat therein, and fix

it there with wooden pegs; if the branch be short, two pegs will be sufficient, but if long, use three. The intervening part of the branch must not touch the ground. After a little time the buds upon this prostrate branch will shoot upwards, like the teeth of a rake; when they are about five inches long, leave one shoot, and cut off the rest, with which you may feed the young silk-worms. During the months of April or May, or some fine day, in the forenoon, take some well-prepared vegetable mould, and heap it upon both sides of the lateral branches of your mulberries, when the lateral branches will become roots lying along the ground. In the evening, water the whole plant, and the same night, the lateral branches will shoot out little fibres of roots, and in the autumn, the branches thus laid down will spring up into fresh plants. Then in the month of November, or in the spring of next year, cut off the lateral branches, take them out of the ground, cut them up into pieces like little sticks, and set out each one of these, that they may become new plants. In this way you may propagate your plants to any extent.

The Woo-pun-sin-shoo exhibits another method of setting out the branches as follows; In the latter end of autumn, when you have leisure from other agricultural business, and when you are deficient in plants, and are anxious to procure more, prepare a place by digging; let it be in some spot where the soil is light, and will retain its dampness through the winter; make some holes about two feet deep, and as many wide; take a ladleful or two of ripe manure, mixing it with some soil, throw it into each one of the holes; the earth in them should be high towards the north, and low towards the south, in order to allow the snows of winter and the rains of spring to flow off from the surface; in the month of January, select two or three branches of some flourishing plants of the white mulberry, binding them together in one, cut them off with a sharp knife, singe the ends a little in the fire; let every five and forty twigs be interspersed with a layer of straw, and the whole bound up into a bundle and put into the hole open towards the south; the hole should be about three or four feet deep, having been dug some time previously, because in the winter the

ground may be frozen to some depth, rendering difficult to dig it; cover over the bundle of twigs with a thick layer of earth; then, after the vernal equinox, take them out, and opening up the holes which were formerly described, pour into each three or four ladlefuls of water, with twenty or thirty grains of corn; then take your mulberry-branches and curling them up into a ring, bind them fast with straw, and lay them down in the holes; cover them over with three or four fingers of earth; and when the young shoots spring up three or four inches above the surface, cover them over again with a layer of earth about a foot or more in thickness, all beaten down firmly, but let some light earth be put over the shoots, and when these spring up again, they will easily make their way through the light soil. Let some species of hemp be previously sown to the south of the hole, to shade the ground and keep it moist; for which purpose, also, you must perpetually water it. When all the twigs that have been laid down shoot up and appear above the ground, and the young shoots become tall, cut off their side branches, and in three years they will become trees, or they may be planted out for ground-mulberries.

Another mode of planting out mulberry-twigs, is to take those mulberry-branches which have been already buried, and cut them off into sticks, two or three of which may be tied together, and planted out according to the mode just described; but a more excellent plan would be to pass each stick through the body of a turnip-radish, in order to borrow something of its strength, after which you may dig your hole, and bury it according to the common method.

In setting out the branches, if the mulberries formerly planted are very numerous, you can break off many of the young shoots; but if they be few, and you are afraid of cutting off too many, and thereby interfering with the supply needed for the worms next year, you can select either of the three methods, viz. sowing the seeds, pressing down the branches, or setting them out, as occasion may require.

The Sze-nung-peih-yung thus describes the mode of sticking in

the branches: having fenced in your garden, dig some holes, according to the method used in planting the ground-mulberry; and then about the time when the green buds upon the branches of the large-leaved white mulberry begin to shoot forth, take some twigs of the same, and having cut off the two ends, singe them a little, and stick two or three in rather a slanting direction in each of the holes which you have prepared; and when the buds come out, heap up light earth over them several inches thick; leave only one shoot on each twig, which in the autumn will be several feet long; and next year you may cut off both branches and leaves, to feed the worms. The only thing to be apprehended is the heat in the dog-days, but if you water and shade them well, the plants will invariably live. Should there be no trees at hand from which you can cut off branches, select some of the large-leaved mulberry growing elsewhere; cut off the branches in the month of January, and bury them in a pit, and when the young buds upon the mulberry-branches are just shooting forth," and when on opening your pits, you perceive that the buds of the buried twigs are sprouting out, cut them off, singe, and stick them in as above described.

Heuen-hoo says, We have been told in the Tse-min-yaou-shuh, to transplant the young shoots after the seed is sown, and then to set them out in rows; while the Woo-pun-sin-shoo tells us, to set them out in rows after they are sown, without any intermediate transplanting; but the fact is, that both plans may be followed.

The Sze-nung-peih-yung recommends the following plan, for planting out the mulberry-trees: cultivate in your nursery a number of small mulberry-trees, of both the white and black species; when you wish to transplant them, in the month of January previous, cut off the extraneous branches; but leave on the small trees three or four branches near the top, and on those trees the stems of which are about a foot in circumference, you can leave a dozen or more branches, each of them about a foot in length; all the rest you may cut away. In the following spring, when the mulberry-buds begin to shoot forth, dig up the trees, roots and all, and plant them in a loose soil, in rows about 24 feet

asunder, and the trees in the rows distant from each other about twelve feet. Plant them opposite one another. The trees should be planted in such wide rows, to admit of the ground being ploughed between them, and to allow of their growing to a large size; thus the ground will not be wasted, and the growth of the mulberries not impeded. Surround the whole plantation with a thorny hedge. The horizontal branches that shoot out in the first year, may, in the month of January, be cut off in a regular manner; and in the following spring, the leaves which they produce may be given to the silk-worms.

The same work says, The pruning of the mulberries should take place at the proper season, that the branches and leaves may afterwards become more exuberant, and shoot out the earlier; let not the work be put off until the young silk-worms are hatched. Should the work of pruning in each current year be performed at the proper season, the long branches will be exuberant, and the leaves in the following year will come out earlier and better. In order to prune the trees with advantage, you must cut away the central branch, so that a person might stand upright inside the tree, and turn about to prune all round, when the leaves and branches will fall off on the outside; this will be more convenient than carrying about a high stand, and going round the tree to cut away the branches; and by this means, one man could do the work of several. The branches must not be superabundant; for superabundance of branches, arising from the neglect of pruning, causes the leaves to be thin and insipid; hence pruning the trees is of the greatest importance in rearing silk-worms. People in general do not know that this operation should be performed when they have leisure from the various duties of husbandry, and vainly expend their strength at the very season when they ought to be most busy with the silk-worms. Thus they give themselves additional labour, and the silk-worms lose the benefit of their care. But if they were to follow out the proper method, and cause the stumps of the trees readily to shoot forth their branches, and the branches easily to produce their leaves, the worms would not have to wait for their food, and the leaves would come out at the pro-

per season, while they would be also thick and exuberant. An agricultural proverb says, Each stroke of the hoe will produce three inches of fertility, and each cut with the pruning-knife will insure a double springing of the mulberry. One work says, That in order to thin the mulberry, you should clear away its superfluous branches in January, and let those which remain be exceedingly scanty. Moreover, upon those branches which are left, let there be only three or four buds, all the rest being cut away; then those which are allowed to grow will, in the course of the same year, be an inch or two in diameter; and the young twigs which shoot out from their buds, will be about three or four feet long; while the leaves will be doubly plentiful, and bright and glossy as if they had been constantly watered. When the silk-worms are approaching maturity, and you strip these branches of their leaves, allow one branch on the outside to remain: this, if well taken care of until the autumn, will become about ten feet long, and in the month of January, must be pruned as before described. After several years, the branches which are left being too numerous, you can cut them all down to the bottom, thus going through the same routine again and again. In the province of Ho-nan and Shan-se, the same method is pursued; but in Shan-tung, and the region north of the Yellow River, a different plan is adopted. It is necessary for people to prune or leave the branches, according to the requirements of the climate and soil, and we must not venture to render the mode of pruning uniform in all.

Another method of pruning is described as follows: When you transplant your mulberries, cut away the middle branch; this being removed, the branches will all grow towards the outside; thus when the tree is grown up, it will have a hollow place within, which will allow of a person's standing up in the middle. If the tree has already grown up, possessed of central stem and outward branches, the former may be cut away. In describing the method of pruning away the branches, the writer says, That there are four kinds which may be especially cut away. First, the *dripwater branches*, or those which hang down, like the willow;

secondly, the *self stabbing branches,* or those which grow towards the centre of the tree; thirdly, the *double-finger branches,* or those that grow together, of which one must be removed; fourthly, the *thickset branches,* or those which, though growing properly, are too bushy. January is the best month for this operation; February is the next best; for in the month of January the sap of the trees has not yet ascended; it is also a season of leisure from agricultural employments. People prune their trees in the spring, merely because they find it a little more convenient to strip off the bark at that season, (for the purpose of making paper;) but by doing it then, they injure the sap. Should they wish to make use of the bark of the mulberry, they should take the branches which have been cut down in February, and cover them up with earth exposed to a southern aspect, and then in March, they can take them out, and strip off the bark (for paper-making.)

The Sze-nung-peih-yung says, That the best time for ingrafting is when the weather is mild; for this operation, an experienced and careful hand is necessary; the binding up should also be firm, and the outside wrapper should be thick, so that the cion be not loose, shallow and frost-bitten. About ten days before the vernal equinox is the best season; five days either before or after this, is the next best; but you must take the branches, (that are to be ingrafted) just when the buds are green. These remarks are made without reference to whether the place from whence you are to get your cions be near or distant; in such matters you must adjust the operation accordingly; but you must perform it on a fine day, in order to avail yourself of the genial influences of the weather. If the cion be not fitted closely, the sap will scarcely be able to pervade the branch; if the binding be not tight and thick, the wind and cold will get in and injure it. It is generally observed, that fruits produced from the original tree are small and ill-tasted, but when once they are grafted, they become larger and better flavoured; this is the case also with mulberries, hence the necessity for grafting. When in grafting, you use such cions as are brought from a distance, you must first prepare them,

and cut them off, in the proper season. The mode of selecting and treating these, is the same as that which has been already described under the head of transplanting mulberry-twigs; if the place from which you get your cions be distant, you can put them in a new jar, that has not yet been used for oil, wrapped up in rushes and imbedded in straw; let the jar be closely sealed on the outside, so that no air can escape, and then if conveyed for hundreds of miles, your cions will neither be frozen nor injured.

Heun-hoo says, Cions of the same year are best for grafting; the time selected should be in the last or first quarters of the moon; the last day of the moon is the best of all. The period between the first and last quarters should be avoided, more especially the full moon.

The mode of grafting by splitting is as follows: first saw off the stem of a tree near the ground; then at the distance of an inch and a half from the top of the stump, cut with the point of a sharp knife, verging to the right and left up towards the top, two slanting cuts in the bark; these cuts must be pointed towards the bottom, and one finger broad at the top; all the substance between which must be cut away; so that the hollow place be in shape like the opening of a bird's mouth, with the bottom pointed, and the sides gradually widening towards the top. The cion should be about five inches long, and about the thickness of a finger, a portion of it should be inserted in the incision in the stump just described; for this purpose it must be cut away on the right and left, in a wedge-like shape, like the corner of a grain of buck-wheat; this you should hold in your mouth for a short time, to render it warm, and then insert it in the incision already made in the stump; but it must be done very smartly and exactly, so that the veins of the old tree correspond with those in the cion. Having thus grafted several cions upon one stump, take some fresh cow dung, mixed with mould, so as to form a sort of plaster, and apply it all round the place of grafting: then take some fresh mulberry-bark and bind it round tight; over this apply an additional layer of a plaster made of mould and cow-dung;

and upon this a quantity of moist earth about five inches in thickness, just over the place of grafting: surround the whole with thorns and briars to protect it. When the cions have sent out a few branches through the layer of earth, about one or two feet long, retain two or three of these, and crop them up as elsewhere described.

Another writer says, In grafting large mulberries you should do it by means of splitting, and inserting the cion; but in grafting small mulberries, you may do it by adding the cion on to the old branch, and by pressing the one down upon the other. When you graft the cion on to a stump cut off near the ground, you should apply a layer of earth, as just described; but when grafting on to a tree that is only half cut down, it will be merely necessary to paste some paper over the juncture, and to tie it up with some old matting, making the envelope in a cupshaped form, in which you can put some rich mould, to nourish it and to keep the air from getting in; for this purpose a cup without a bottom may be employed instead of the matting. When the mould is dry, sprinkle it with some water; when the shoots spring out through this coating of mould, do not take away the covering, until the autumn branches are well-grown: after which, the graft being thoroughly fixed, you may remove the covering. If the grafts all succeed, then observe whether the number of side branches corresponds with the strength of the tree, and cut or retain them accordingly. The method of grafting by pressing the new buds down upon the branch of the old stock is as follows: cut off one of the horizontal branches, leaving a foot or more on the tree; you need not, however, be very particular about feet and inches, but be guided by the vigour and size of the tree. About half an inch on either side of a bud on the cion from which you are going to graft in, make an incision in the bark with the point of a knife, as deep as the wood; then strip off a square piece of the bark, on which the bud is; on the wood of the branch where the bud was, you will find a small eye, about the size of a grain of rice, which is the root of the bud that has sprouted forth; when you strip down the

bark, pick off this with your finger nail, so that the little eye attaches itself to the bark. Hold this piece of bark in your mouth for a while, and then taking it out, make with it a moist place on the horizontal branch; again put the piece of bark into your mouth, and with the point of a knife, all round the moistened part, make an incision in the bark, which strip off until the wood appears; then take the piece of bark, with the eye upon it, and stick it on to the branch; take care, however, that the eye be upwards; then take some small thin strips of new mulberry-bark and bind the upper and lower pieces together. Use a little judgment in the binding, so that it be neither too fast nor too loose; if the former, the growth will be impeded; and if the latter, the parts will not adhere. Make use of cow-dung mixed with earth, and plaster all round the little eye. The number of little eyes, or buds, thus attached to a single tree must be according to its size.

With respect to grafting young mulberry-twigs, you can take a shoot of the black mulberry which a year previously had been planted out in the furrow, and cutting it off a few inches above the ground, shape the top of the cutting like a horse's ear; then take a cion of the white species, of an equal size, shaped in a similar manner, and join the two together. Bind them round with narrow strips of mulberry-bark, plaster them over with cow-dung, and cover this with moist earth. When the young buds shoot out beyond this covering, you can retain one or two, which in the autumn will be as tall as a man, and next year may be transplanted into the garden, when you can treat it as has been already described. When you wish to separate the thickly-planted grafts from amongst these which are near them, and plant them out in a wider space, you should select high and hilly ground where the soil is thick and the water scarce, in which you must dig several deep pits; in these plant the mountain-mulberry; these pits may be from ten to fifteen feet in depth, out of which the trees will grow straight up, with few branches on the sides; the stems of these trees will become unusually straight, and after ten years, may be employed for any purpose.

The Po-wan-luh says, The leaves of the mountain-mulberry are plentiful, but the branches are few and straight. The leaves being thick and abundant may be given to the spring silk-worms; the silk produced therefrom must be reeled out of cold water; hence called cold-water silk. The silk-worms fed on the mountain-mulberry come out earlier, awake from their torpor sooner, and begin to form their cocoons before the others. But the leaves of the mountain-mulberry which remain on the tree over the winter must not be used; such one flourishing again in the spring will injure the silk-worms: those therefore which have not been picked the preceding summer must all be knocked off, and then the injury to the worms will be prevented.

The Tse-min-yaou-shuh says, The plan for cultivating the mountain-mulberry is as follows: plough your ground well, and form it into furrows: when the berries of the mountain-mulberry are ripe, take a great number of them, wash them clean in water: dry them in the sun, and after having sown the seeds, rake them in. When weeds spring up, remove them, and do not allow your young plants to be choked thereby. After three years, cut off the superfluous branches, which may be used for walking-sticks; after ten years, they will be large enough to split into four for the same purpose, or for horse-whips, or bed rails; after fifteen years, they may be used for bows, or clogs, while the smaller pieces that are cut off may be employed for knife or awl handles: after twenty years, the wood will be good for making carts or saddle-trees. When this kind of mulberry sends forth branches, about three feet long, you can tie some of the side branches and peg them down to the ground; they will thus assume a crooked shape, and form what are called mulberry-arches; but in order to form the branches so as to be fit for bows, you must plant the mountain-mulberry in a shady place.

The leaves of the mountain-mulberry are rougher in taste, and thinner than those of the common mulberry; they are also about one-fourth deficient in quantity. They attract moisture from the sky, and cause snails to abound. If you plant Sze-chuen millet between the rows, the tops and leaves being of the same

height with the young mulberries, the latter will grow bushy, but not luxuriant. If, however, you plant green or black pulse, linseed, or melons, between the rows, the mulberries will be both bushy and luxuriant, and the leaves, on the following year, will be one-fourth increased in quantity: you may also plant common millet; for as a book on agriculture says, the mulberries promote the growth of the millet, and the millet that of the mulberries; which remark, generally speaking, is right.

The Woo-pun-sin-shoo, on this subject, has the following suggestion: Let two families in a given village unite, construct a fence round a spot of ground 100 fathoms on each side; for the more numerous the individuals engaged in an enterprise of this kind, and the wider the space of ground occupied, the greater economy will there be of labor. Let each family construct 200 fathoms of the fence; the space of ground within the enclosure will amount to 10,000 fathoms; on each fathom plant a mulberry-tree; thus you will have 10,000 plants, 5,000 falling to the share of each family. Should, however, one family undertake it alone, and construct 200 fathoms of fence, the space of ground inclosed will only be 2,500 square fathoms, and allowing as above, one mulberry-plant to each fathom, you will only have 2,500 mulberries within your enclosure; thus unequal will the results be. Should you be apprehensive of the parties quarrelling about boundaries, you can in the centre of the ground mark off the line of separation; which plan compared with that of each family constructing a separate fence, will not only enable you to inclose more mulberry-trees, but also to assist one another in labour, and get on better by association.

The same work alluding to taking the mulberry-bark for paper-making, says, In the beginning of spring, cut off the more exuberant branches: for the bark from newly-budded twigs is the best; a month later is the next best time for doing this. The wood of the mulberry is good for making bows, as bows made of this wood are particularly elastic. The southern-wood planted among mulberries, forms a very fine vegetable; and of all the wood-ears,

or boletus, viz. those from the mulberry, elm, willow, &c. the former are the best.

IMPLEMENTS USED IN SILK-CULTURE.

CLOSE-STOVES AND BARROW-STOVES.

In all the apartments for rearing silk-worms, stoves should be constructed on every side, hollow within, and supplied with smouldering fires, which should be equally distributed. Silk-worm rearers generally make use of charred wood; for should the smoke arising from the fires get up among the silk-worm baskets, the insects will be injured and blackened thereby.

People in the present day, make use of handbarrow stoves, in which wood or cow-dung fires have been kindled outside, and which are then brought in, carried between two persons. The fire in the stoves should be equally adjusted, and either increased or diminished, according to the state of the weather. For if the heat be not well regulated, the worms will fall into or recover from their torpor at irregular intervals. The Work on agriculture says, Silk-worms belong to the element of fire, and therefore must be reared by the assistance of fire; in order to which stoves must be employed that can be taken out and in. Let the fire in these be kindled outside, and covered over with the ashes of burnt straw, by which means the flame will be deadened. The method of bringing them in is, by means of a low crib, in which a stove is fitted having handles projecting on either side, so that two men can carry it, and bring it in when necessary.

SILK-WORM HURDLES.

These hurdles are for placing the silk-worms on. The Le-ke speaks about preparing the hurdles and frames, with allusion to these. Yen-sze-koo, in commenting on this passage, says, These hurdles were made of reeds. In the north, the rearers of silk-worms are numerous, hence at the back of the farm-houses, or between the gardens, reeds are planted in great abundance, for the purpose of making these hurdles; after autumn, the reeds are cut down, and the farmers are in the habit of constructing the hurdles themselves. They are generally about 40 feet in circum-

ference, supported on a couple of beams, and then arranged upon the frames; so that when the silk-worms have to be separated, removed, or cleared of their litter, they can be easily rolled up or opened out. In the south, reeds are very abundant, and farmers should the more employ them, to extend the business of rearing silkworms.

SILK-WORM BASKETS.

These were anciently employed for holding silk stuffs; those which are at present used for rearing silk-worms being of the same form are called by the same name. The shape is round or rather oval; they are shallow, and surrounded by a rim, and very well adapted for holding the worms. They are used from the time of hatching, until the time when the worms have to be separated farther apart. They are supported on bamboo stands, so that it may be the more easy to remove or to feed the worms. In the north, people use hurdles, and in the south baskets, both of which are implements employed in rearing the silk-worms; speaking of them separately, however, the people in the south use hurdles, when the worms are large: those in the north use baskets, when the worms are small; thus they both of them use hurdles and baskets as occasion requires.

SILK-WORM TRAYS.

These are for putting the silk-worms in. Tsinkwan, in his work on silk-worms says, "When the worms are first hatched, the internal divisions of the trays for their reception are a foot square, and when the worms are about to spin, the same divisions are increased to a foot and four inches. They are made of matted reeds, and the outer frame-work of bamboo, seven feet long, and five broad; when used for baskets, a space of nine inches is left between each basket. The frames have ten such partitions, on which to place the silk-worms as they are fed. In the present day people denominate their baskets trays, and use wooden frames for them, having the bottom made of open matwork, placing these upon the stands, as above described."

THE STAND FOR SILK-WORMS.

According to the Le-ke, in the latter month of spring, the people were to prepare their hurdles and frames, which latter are the stands now spoken of. The Woo-pun-chih-yen says, At the Kuh-yu term (April 22) set up your stands, consisting of four posts, each of them higher than the pillars on which the leaves of the house rest, (which the upward slope of the roof will admit of); let the stands be set up in each apartment of the house; on the outside of the posts thus set up, make several deep incisions, like the teeth of a saw, and fasten rings on these, made of the bark of the mulberry; (because hempen cords are not suited for tying silk-worm apparatus). On the four corner-posts fix two long horizontal poles, upon which you may spread the reed hurdles; let these slant a little outwards. The stand should have ten of these fastenings, separated from each other about nine inches apart, and capable of being moved up and down, as you feed or remove the silk-worms.

The Nung-sang-chih-shwo says, Upon each division of the stands, let three layers of hurdles be spread, upper, middle and lower; the upper ones to catch the dust, the lower ones to keep off the dampness, and the middle one to be ready for separating and removing the worms.

THE HORIZONTAL POLES USED FOR THE SILK-WORMS.

These are intended for the support of the silk-worm hurdles; they may be either of wood or bamboo; they should be about 12 feet long; two of them should be used together; these being placed upon the stands, to bear up the hurdle, should be straight and of a light material, also of a material that will not be readily attacked by worms.

THE FRAMES FOR THE SILK-WORMS.

These are for putting the silk-worm trays or baskets on. These frames are made of four small pieces of pine-wood, set upright, about eight or nine feet high, joined together above and below by bamboo cross-pieces forming ten divisions. On each of these divisions, the silk-worm trays or baskets are placed, according to their size; for the baskets a smaller, and for the trays a larger kind of frame being employed. Thus in the southern

regions the trays and baskets are arranged on frames, as in the north the poles and hurdles are placed on stands.

THE SILK-WORM NETS.

These are for the purpose of removing the silk-worms; they are made of knotted strings, like fish-nets; being in length and breadth according to the size of the trays. They should receive a coating of oil or varnish, to strengthen and preserve them. They should have a rope passing all round them, for the convenience of holding and moving them about. When the worms have to be removed, first spread this net over them, and then scatter some mulberry-leaves upon it. The worms perceiving the fragrance of the leaves, creep through the meshes of the net to eat the leaves that are upon it; wait until they have got upon the leaves, and then lift the net with an even hand over to another tray, when you may clear away what they have left. This is much more convenient than removing the worms by the hand. In the south they make frequent use of the net, and in the north also when the worms are small.

SILK-WORM LADLE.

This is made of wood hollowed out; the bowl of it large enough to contain a double handful; the handle is upwards of three feet long. Should there be any vacant place on the hurdle, or should the leaves be unequally distributed, then this ladle may be used for the purpose of filling the one or adjusting the other. When the worms have arrived at maturity, and are to be put upon the bush, should they be too thick in some parts and too thin in others, they can be distributed more equally by means of this ladle. Should the ladle not be long enough, it can be lengthened by the addition of a bamboo attached to the handle. This is the plan adopted in the southern silk-worm establishments. The stands and hurdles employed in the north being rather large, and it being scarcely possible to reach with one's fingers every part, this plan may also be adopted there for convenience sake; the suggestion should at any rate not be slighted.

THE SILK-WORM BUSH.

The Nung-sang-chih-shwo says, For bushes use southernwood stalks, brushwood, or matting. Whenever you wish to make a bush, first form the centre of the bush: which is made by five poles (an upright one in the centre, and four slanting ones on either side) bound together in one at the top, and joined on the outside by reed hurdles tied, round them; all round this centre set up, at equal distances, stalks of southernwood; and when you have thus spread out the silk-worm bush, surround the whole with hurdles and mats, bringing the top of the bush to a point like a dome; this is called the round bush. There is also a wharf-shaped long bush, the centre of which is formed by means of two upright posts, joined by a horizontal pole, and crossed by smaller sticks one on either side; the rest of it is constructed as above described. These cross bushes are used principally in the north. In the south we observe, that people commonly bush their worms in the house upon the silk-worm frames, on which they spread short grass for bushes. This is indeed a saving of labour, and keeps the worms from injury. In the southern books on the silk-worm cultivation, we read, that the bushing hurdles are supported on pine-wood poles, about six feet long, and three broad, having holes like horse's eyes, made of the dwarf-bamboo, in which bundles of grass are stuck at equal distances from each other. Then take some bamboo reeds, stripped of their leaves, and lay these across; defend the back of the bush also with reed-hurdles, tied through to the upper surface with bamboo fastenings; thus the silk-worms will have a secure footing, and will not be in danger of falling through. This is the plan of bushing used in the south; comparing this with the plan used in the north, detailed above, we should consider that the silk-worms differ in quantity in various places; hence the bushes are either large or small, and are formed with ease or difficulty, as the case may require. Viewing the matter rightly, however, it appears, that both the northern and southern plans are capable of improvement. In the south the silk-worms are fewer, and if their mode of operation be contracted and apparently insignificant, we should remember that their profits are also few; and in the north, although

the bushes are large, the failures are also numerous, while the heaping up of southernwood for bushes cannot fail to press heavily on the worms. Some injury likewise arises from rain and damp, requiring the bushes sometimes to be inverted. But whether the bushes be outside or in, they are exposed to the variations of cold and heat, or the shiftings necessary from the worms being placed too high or too low, too sparse or too close; by which means bush-sicknesses are generated, and the cocoons produced are fewer in number. Having been accustomed to the present mode for a long time, it is difficult all at once to induce people to change the practice: but we have recently heard of a plan adopted by a skilful rearer of silk-worms; which is, to calculate how many silk-worms are about to be reared in the establishment, and then select a vacant place in the court-yard, and having provided poles and matting, to construct a long shed, which may be used on common occasions for other purposes; and when the silk-worms are about arriving at maturity, place the bushes therein, according to the length of the shed; the centre of the bush must first be made hollow within like a tube; then a channel may be dug along the ground, of the size required; leaving a space round the bush large enough for a person to walk in, in order to guard against fire. With regard to the employment of fire, the works on the silk-worm cultivation say, when the worms have entered the bush, use a smouldering fire to warm them, and when they have fixed their threads, in the centre of which they are to form their cocoons, gradually increase the heat, and let it not go out in the midst of the operation; for if there be the least cold, the worms will begin to wander, and also stop spinning; which will occasion a breaking of the threads in reeling. Should many such cases occur, the cocoons will then be only fit for carding as silky cotton, and cannot be reeled off to the end. All round your centre bush set up some frames having several compartments; upon each of which lay down some stalks of southernwood, and place the silk-worms evenly thereon. This done, surround the whole with a double hurdle; if the silk-worms are few, and the house roomy, you may bush the worms inside, having opened wide the doors and windows; in this way you will have the benefit of the shelter

of the roof above, and be able to keep off the damp from below; the frames also being large and roomy, the silk-worms will be able to work at their ease. Should you wish to make use of fire, also, you will find fuel at hand. Taking all these things into consideration, should we select the advantages and reject the disadvantages of both the northern and southern plans, we should be able to hit upon a good method, which could be generally used, and carried out to the end with approbation.

THE SILK WORM JARS.

The books on the silk-cultivation say, Whenever you want to plaster down your cocoons, arrange a number of large jars along the ground; at the bottom of the jars first place a bamboo frame-work, cover this over with the leaves of the Dryandria cordifolia, and spread upon it a layer of cocoons, about ten pounds weight, over which sprinkle about two ounces of salt; upon this, spread some more leaves of the Dryandria: and thus go on layer after layer, until the jar is full, after which you should close it up well, and plaster it over with mud. After seven days, take the cocoons out and reel them off, taking care to change the water frequently, if you wish to get your silk glossy and easily reeled. It is because the cocoons are numerous, and people have not time to reel them off, that they steep them in salt, by which means the moths will be prevented from coming out, and the silk will also be tough and glossy, without being uniformly small. This is the mode of steeping the cocoons employed in the south; which requires, however, many jars that may not be always ready. We have read in the northern books on the silk-cultivation, that it is better to reel off from the cocoons, while the moths are still alive; but if you have not hands enough, and being able to reel off but slowly are obliged to kill the moths in their cocoons, you will find that there are three methods for effecting this; first, by exposing them to the sun; secondly, by steeping them in salt; and thirdly, by steaming them; of these the method of steaming-baskets is the best, but few people understand it; exposing them to the sun injures the cocoons; hence steeping them in salt in jars, is most to be recommended.

however, only two inches in diameter. It may be made of elm or senna-wood, either four-square or hexagonal, the former being preferable. The arms pass through the spindle, and are three feet and a half in their whole length. The smaller the reel, the more easy is it to get the silk off.

The frame is for the support of the reel and its spindles. One end of the spindle may be cased with iron; or a bent piece of wood may be used to sustain that part of the spindle that works; when with the left foot you press down the foot-board, and turn the reel, guiding the silk from the pan below on to the reel, the general name for the operation is the reeling of silk.

SILK-WORM CARDS.

These are the pasteboards upon which the silk-worm's eggs are deposited. Formerly people used two large sheets of paper joined; and when the moths had deposited their eggs, they sewed them together by means of a thread; hence they were called leen, joined sheets. In the present day, cards are made on purpose for this business. The Woo-pun-sin-shoo says, The silk-worm cards should be made of thick paper, because thin paper will not bear the soaking. The most fitted for the purpose, however, is paper covered over slightly with ashes. The cards must be soaked at the proper season, and after soaking must be hung up to dry, with the eggs outside, lest the wind should blow the cards about and injure the eggs. The washing of the eggs should take place at the winter solstice, and about the beginning of January; but let them not be sunk too deep in the water, and after washing, let them be taken out; about the middle of January roll up several cards together, and tie them up with string made of mulberry-bark; then hang them up on a high pole in front of your house, that they may be refreshed by the cold air of winter. After the new year is over, in the month of February, stick up the cards erect but wide apart in jars, and in about a fortnight's time, when the sun is high, take them out again; also dry them after a rainy day. This is the method to be pursued in washing the cards, and taking care of them until the eggs are hatched by the return of spring.

DESCRIPTION OF PLATES REGARDING THE MULBERRY.

Wang-ching says, Silk-worm rearers whilst cultivating the mulberry-trees, should be provided with hooks, baskets, &c. in order to manage this business. But in places far distant from each other, the customs are different; therefore the regulations are in some places intelligent, and in others unskilful. One man puts forth double efforts and yet cannot equal his neighbour; while another perhaps with small exertion produces results doubly beneficial. We shall therefore collect together such things as have been recorded, pointing out what is deficient, and what superior; that people may know what they ought to choose and what refuse. The implements employed in the cultivation of the mulberry, are necessary for the rearing of silk-worms, hence they are here described at the close of our treatise on the silk-cultivation.

THE MULBERRY-STAND.

The form of this is like a high stool, with two even bars across, so as to form a sort of steps. The weak mulberry-trees will not bear to have a ladder placed against them, hence it is necessary to mount this stand, and you will easily reach the leaves. The Tse-min-yaou-shuh says, A high stand is necessary to pick the mulberry-leaves. The Sze-nung-peih-yung says, Carry about a high stand, and you may go all round the trees, above and below.

MULBERRY-LADDER.

This ladder is a sort of steps. In gathering the leaves from the young mulberry-plants, you may use a stand, but to lop the twigs from the higher trees, a ladder is requisite. If the ladder be not long enough, you cannot avoid climbing and leaning on the trees. If you pull down the branches, without letting them spring back again, you will cause them to entwine in confusion; so also if you bend down the branches and break them off, the sap and gum will flow out on one side. If therefore you wish to stretch out your hand to the highest and lowest parts, and take or leave the leaves just as you please, a long ladder is indispensible. The Tse-min-yaou-shuh says, In picking the mulberry-leaves, it is necessary to use a long ladder, without which you will be in danger of breaking off the higher branches.

Heuen-hoo says, When salt comes into contact with the worms, it sometimes renders them damp; on which account, people in the present day, merely put their cocoons into the jars, and then make use of some paper, or the external wrapper of the bamboo, or the leaves of the nelumbium, to wrap up a couple of ounces of salt, which they put on the cocoons. This plan will also do. Only the mouths of the jars must be well stopped up, so that no air escapes; if this be done, it does not matter what is put in the jar; not to speak of salt, mud will do.

TEH COCOON BASKET.

This is used for steaming the cocoons. The Nung-sang-chih-show gives the following directions. Make use of three tiers of baskets; take some soft straw, and make a ring of it; put this on the mouth of the boiler, place two tiers of baskets on this; in the baskets let the cocoons be equally distributed, to the thickness of three fingers; frequently try on the top of the cocoons with the back of your hand. If you cannot bear the heat, take away the lower tier of baskets, and put another on the top. In this way, they must be changed, up and down, which makes it necessary to use three baskets. Do not steam them too much, for if you do, the ends of the silk-threads will become soft. So also you must not steam them too little, lest the chrysalides should perforate the cocoons. Just when the hand will not bear the heat is the criterion by which to judge, when they are properly steamed. This is the way in which to steam the cocoons in baskets.

ON THE MACHINE FOR REELING.

In reeling the silk, the threads are wound off from the surface of the pan; where they are passed through the holes of copper cash, and conducted upwards to the spools; the spool-frame in its motions corresponds to that of the machine. From the spool-frame the threads pass on to the layer, or rampin-board, and from thence to the reel, where it is wound off.

Tsin-kwan, in his work on silk-worms, thus describes the machine for reeling. The perforated copper cash are fixed into a board, which is longer than the diameter of the pan; three inches

broad, and a quarter of an inch in thickness; in the middle of the board, at the thickest part, a copper cash is fixed. The board projects over the sides of the pan, through its ears, and is kept steady by a stone. The winding spools are made of little hollow bamboos, about four inches long, perforated by spindles. Two pieces of bamboo are stuck up on each side of the pan, to form a spool-frame. Having inserted the spindles into the spools, fasten them on to the machine, just over the perforated copper cash; these are then called winding spools, which move in unison with the machine, and conduct the threads on to the layer or rampin-board. The rampin-board is attached to one of the hinder posts of the machine, upon the top of which a hempen ring is placed, about a foot and a half in circumference. On the other hinder post of the machine is fixed a pivot, about an inch and a half long, upon which a drum or nave is made to turn. The drum is also provided with an indentation for the reception of the band; this when the machine is in motion, is continually revolving without intermission. The drum is turned thereby; upon the drum is a fish, or horizontal stick, which projects half over the drum; in the projection is an upright pin, about half an inch long, upon this is fitted the rampin-board, which is a flat piece of bamboo, about two feet and a half long. On this rampin-board are two hooks made of bent bamboo, which are to guide the winding of the silk; one end of this rampin-board moves upon the little pin, which is opposite to the drum as an ear or handle. When this is inserted, and the rampin-board fitted on, as soon as the machine is put in motion, it draws round the band, the band turns the drum, the drum makes the fish play round, and the fish moves the rampin-board backwards and forwards; in this way the silk is prevented from being wound off flat. The reel itself is a sort of wooden spindle; with arms and rails, two sets of the arms being moveable with hinges, for the convenience of taking off the silk. It appears that, what is by some called the winding-frame, is by others denominated a reel; the reel, however, must be fitted into a frame.

The spindle should be about two feet long, and four inches in diameter; the part that works on the top of the frame-posts is,

MULBERRY-HATCHET.

This hatchet has an oblong hole, and a broad edge, differing in some respects from a wood-man's axe. The Book of Odes says, "In the month when the silk-worms come out, lop off the branches of the mulberry, for which purpose use hatchets and choppers, and cut off those that are distant and wide-spreading." The Sze-nung-peih-yung, in explaining this passage, says, "Wherever you turn take the hatchet with you, and let the branches and leaves be cut, so as to fall off on the outside; which is called cutting off those that are distant and wide-spreading. Whenever you use this hatchet, it is well so to cut with it as to obviate the necessity of repeating the stroke. Meeting with dry branches and hard knots, it is better not to let your hatchet be still, and it is still better to keep it well tempered, in good repair, and always sharp. There is, however a method to be observed in using the hatchet, which is to turn your wrist, so that the edge be kept from you, and to cut upwards with it, in the direction of the forks of the branches, by which means the sap will be kept from exuding; thus the leaves will become more exuberant." The Agriculturist's Manual says, "The hatchet, if properly employed, secures a double quantity of leaves; by this we see, that the advantages of pruning entirely depend on using the hatchet well."

THE MULBERRY-HOOK.

This is for pulling down the mulberry-branches. Gatherers of mulberry-leaves, wishing to get at the more distant and wide-spreading branches, must pull them near, in order to pluck them; for this purpose they employ a wooden hook, to save the trouble of stretching out their arms and hands to them. In former times, when people went to gather the mulberry-leaves, they always made use of baskets and hooks. In the beginning of the Tang dynasty, A. D. 750, the rulers are said to have obtained thirteen valuable things, calculated to establish the fortunes of a country, amongst which is enumerated a mulberry hook. From this we may see, that in former times people made use of hooks in gathering the mulberry-leaves. But the practice in the north

is rather to cut off the branches than to gather the leaves; while in the south, they more frequently pick the leaves than lop the branches. But when the trees are lopped every year, the juices thereof speedily dry up; and when the leaves are picked perpetually, the branches get entangled; so that a just intermingling of the northern and southern plans, in which lopping and picking are united, and where the hatchet and hook are both occasionally employed, will secure a double advantage.

THE SILK-WORM BASKET,

Is employed by the gatherers of mulberry-leaves; the one now in use in the south is rather large, and is borne on the back, or carried across a pole.

THE CHOPPING-KNIFE,

Is intended for chopping the mulberry-leaves. When the worms are first hatched, a small knife will do; but as they increase in size, a larger instrument should be employed, or a kind of chopper. When the silk-worms are numerous, a long knife should be used, something like a currier's knife, about three feet long, having a wooden handle at both ends. First lay down your leaves on a long bench, in a rather large bundle, and cut upon them, pressing first with the right hand, and then with the left. In this way one knife will cut up leaves enough for a hundred hurdles.

THE MULBERRY-LEAF NET,

Is for holding the leaves. In making this, first get a small hoop, and form the meshes of the net all round the hoop; let the net be about three feet or more in length; then draw it together by a string, which will form the bottom of the net. This is employed by the mulberry-leaf gatherers, for putting the leaves in; as soon as the body of the net is full, they take it home, and opening the string at the bottom, they discharge the contents. These nets may either be carried on the shoulders, or across a pole, or cattle may be employed for conveying them.

They are more convenient than baskets or trays, and being very light are much used in the north.

THE MULBERRY-LEAF CHOPPING-BLOCK.

This is made of a section of a tree, round, and having the grain of the wood perpendicular, hence it will not offer much resistance to the knife in chopping. In the north, when the worms are small, the leaves are shred upon such a chopping-block, placed on a table; sometimes, however, they use an apparatus resembling a chaff-cutting machine. In the south, whether the worms are large or small, the leaves are all chopped upon a block.

THE PRUNING KNIFE,

Is used for pruning the mulberry-trees; it is about a foot long, and two inches wide, having a wooden handle. In the south, whether they prune or lop, they invariably use this knife. In the north, for lopping they employ a hatchet, and for pruning a reap-hook; this latter, although sharp, is not the proper instrument, and is not to be compared to a pruning knife for lightness and convenience. If the southerners in lopping the branches were to make use of a hatchet, and the northerners in pruning were to employ a knife, they would hit the due medium, and both be right.

THE MULBERRY-LEAF HOLDER.

This is for holding fast the mulberry-leaves. First, get a thick board, and fix up in it two pieces of wood opening out from each other, about two or three feet long; fix a knife so as to cross these; with the left hand supply the leaves to this machine, and with the right hand chop them. This is the smaller kind of leaf-holder. In those establishments where the silk-worms are numerous, they use two long pieces of wood, set up together near the wall, being about a foot apart from each other; between these they throw the mulberry-leaves, to the height of about ten feet; people mount up on this heap of leaves with a part of steps, and with their feet towards the wall, they lean with their breasts forward, and thus press down the mass; then with both hands they grasp a long knife, and cut the leaves downwards. This is the

method employed for grasping the leaves, and cutting them on a large scale. In the south, they merely employ knives and chopping-blocks, for cutting the leaves, and are not acquainted with the methods detailed above: they are therefore described here, in order that those who wish to adopt them may increase their profits.

MYSORE SILK.

PUBLIC DEPARTMENT.

No. 932.

Extract from the Minutes of Consultation, under date the 13th July 1857.

Read the following letter from the Commissioner for the Government of the Territories of His Highness the Rajah of Mysore; to E. MALTBY, Esq., Acting Chief Secretary to Government, Fort Saint George, dated Bangalore, 2nd July 1857, No. 12.

SIR,

In reply to your letter No. 760, of the 10th Ultimo, I have the honor to forward a copy of a Report dated the 1st Instant, in which is embodied the whole of the information acquired in the course of the experiments made by this Government to improve the Silk produced in Mysore.

This Report is the work of Surgeon Smith of the 50th Regiment N. I., for many years in Medical charge of this Commission. The experiments were conducted under his superintendence, and the result of his observations may be relied on, as he spared no pains to make himself acquainted with the subject.

(Signed) M. CUBBON,
Commissioner.

REPORT ON THE SILK CULTIVATION IN MYSORE.

1. The cultivation of Silk is supposed to have been introduced into Mysore by Tippoo Sultan, and although the climate is evidently well calculated both for the growth of the Mulberry, and the development of Silkworm, the cultivation does not appear to have made any great progress until after the government of the country fell into the hands of the British in 1832.

2. The Mahomedans adopted the feeding and management of the worms and the reeling of the Silk as one of the few modes of gaining a livelihood to which they are not averse, purchasing

the Mulberry leaves from the cultivators; and the Commissioner gladly encouraged the growth of Silk in every possible way, with a view of developing habits of industry among a class of men generally opposed to labour of any kind, unconnected with a Military life.

3. The open parts of the country alone seem to suit this cultivation, such as the Bangalore, Chittledroog, and open parts of the Astagram Divisions. None is grown in the Nugger, or in the Munjerabad sections of the Astagram Division, the climate is too damp in these last named Districts. Most of the Silk was formerly exported to Coimbatore and Tanjore, and a smaller portion found its way to Bellary and Dharwar, for consumption in Native manufactures. At this time there is a considerable consumption of the raw material in Bangalore and Mysore in the manufacture of Silk Shawls, Handkerchiefs and Native Cloths, &c.

4. In 1841, four specimens of Silk, grown in Mysore, were sent to Bengal: two of the specimens were purchased in the bazaar and two were from cocoons purchased in the bazaar, and privately and carefully reeled; the object being to find out the defects in the Mysore Silk, and to know if it would be valuable as an export in the state in which it is sold by the Natives. The following are Extracts from the Report: "One of the most ap-"parent faults of this Silk is its bad colour, this arises from the "circumstance of the cocoons having been boiled in copper pans "instead of earthenware, and I should imagine that at the time "of reeling the Silk, the water in which the cocoons were placed "was not changed often, as should be done. This latter precau-"tion would not only have assisted to give the Silk a better "colour, but would have freed it somewhat more from the gum, "the superabundance of which renders these specimens harsh and "hard." It appeared from the above Extract that the faults of the Mysore Silk lay not so much in the article itself as in its mode of preparation.

5. A garden originally planted as a private speculation was taken by the Mysore Government in 1842, with a view to try how far Signior Mutti's proposal of growing Silk from standard

Mulberry trees was likely to succeed in Mysore, and benefit the country. The larger and upper portion of the ground was planted with cuttings of the St. Helena Mulberry, and a few China ones, the lower and wet part with Philippine, both grew well and for the first few years promised well. Eggs were obtained from Mr. Groves's Establishment at Chittoor, from an Establishment in the Neilgherries, and some of the annual March bund from Mr. Blechynder's Establishment in Bengal, these latter being annual worms it was hoped would have proved a valuable auxiliary to the Mysore breed, and enable us to feed from the standard trees, but in spite of every care and precaution they hatched on the eleventh day as in Mysore and from that time regularly produced their crops every 50 days. The Silk was certainly a great improvement on that of Mysore, but the worms were delicate and required more care and attention, so that I much doubt if they were ever extensively used by the Natives.

6. The Sub-Peshkar of Bangalore, a man familiar with the country method of reeling Silk, was sent to Chittoor and placed under the tuition of Mr. Groves, who had an extensive plantation of Mulberries and experienced reelers. The man returned to Mysore well qualified for his post of Superintendent of the Government Garden. Reels of the best construction were made by Colonel Green, and so expert did the Natives become, that, in 1846, the following is the report of the Bengal Chamber of Commerce on the specimens sent for that purpose :—

Report of the Silk Committee on specimens of Raw Silk the produce of the Sirkar Gardens at Bangalore, forwarded by the Agricultural Society at Madras.

"Your Committee have examined these specimens with great "interest, and should be prepared to give an unqualifiedly favorable "opinion on them had the thread been a very little stronger; as "it is, it is remarkably even, round, and free from knibs and "gouts, and the colour very pure and uniform: indeed, with the "single exception of being somewhat too fine, the present are "most admirable samples of Silk."

"Your Committee would however remark that an opinion of-
"ten prevails among such as are not practically versed in the
"manufacture that the finer the Silk the better and more valuable,
"but it may be too fine, and the present specimens, your Com-
"mittee think, are finer than it would be safe to prepare for the
"English market, for the difficulty of unwinding such Silk is ex-
"treme, and adds enormously to the charge of preparing it for
"the weaver. A Member of your Committee (Mr. Laidlay) observes
"that he has known in more instances than one the most disas-
"trous results from the mistake of reeling the Silk too fine, for it
"will not bear to be unwound by the machinery used for the
"purpose in England.

"Your Committee however beg to add, that these specimens
"are in every other respect unexceptionable, so clean, even, and
"beautiful that the reeler who prepared them may be pronounced
"competent to produce Silk of the first rate excellence, nearly,
"if not quite equal to Italian.

"The soil and climate too must certainly be favorable to the
"culture."

(Signed) Robert Watson,
(„) J. W. Laidlay.

Calcutta, March 1846.

To F. S. Gabb, Esq., Secretary, Agricultural and Horticultural Society, Madras.

Sir,

The Honorary Secretary of the Calcutta Agricultural Society has handed to me two sample skeins of Raw Silk, the produce of Bangalore, and a copy of your letter of 26th February to his address, with "Extract from Proceedings of a Meeting of your "Society wherein the specimen of the Silk is ordered to be sent "to the Chamber of Commerce here for report."

"Having laid such communication and the samples before the "Chamber, I am desired to inform you that they consider the "Silk very beautiful, but the thread is too weak for free reeling

"if of stouter thread it would pay well at the price you quote. "Both sorts are too fine for ordinary purposes and could not be "rewound without great waste, even twice their thickness might "be too fine to suit the English market, the staple not being "strong enough to stand the action of the machinery used for "winding and preparing the article for the use of the weaver, "probably about 10 cocoons would afford the best size to reel. "The cocoons from which these specimens were made must have "been very good indeed, equal to the best annual cocoons of "Bengal, but the thread, especially the white, is endy and it is "not twisted enough; with improved implements, and proper direc- "tions, the spinner should be able to produce an article of su- "perior character and higher value."

"Though of minor importance I may here mention that the "skeins would be better if not quite so thick. These weigh about "6 tolahs, whereas the skeins generally made in India and most "approved in England weigh about 3 or 3½ tolahs, a size which "is attended with several practical advantages."

CALCUTTA,
Bengal Chamber of Commerce,
April 25th, 1846.

(Signed) W. LIMONG,
Secretary.

7. The brokers, Messrs. Norton, Thilburn and Co. of Saint Mary Axe, London, reported of some samples of the Silk sent to them in 1850, as follows, "this Silk with care in the getting "up would prove a valuable substitute for many other classes, "and from its intrinsic qualities would find a ready sale in this "market." These Extracts prove the capability of Mysore to produce Silk of first rate quality. But until filatures conducted by Europeans are established as in Bengal but little of the Silk will ever find its way to the English market. At present the natives find a ready sale in India for all they can produce, and it answers their purpose better to reel it roughly and sell it as they do, for although clean reeling will produce a greatly enhanced price, the proceeds of the Silk will be much less and the sale of the raw material not so certain as it is now. Since 1846 the average annual produce of Mysore has been about 10,000

maunds of 24 lbs. or 240,000 lbs. weight, a quantity sufficiently large to attract attention to its cultivation.

The standard mode of cultivation failed for reasons explained in the following Extract from a letter to the Commissioner dated 11th August 1849.

"When we consider the incessant demand for leaves made on the standard trees in consequence of the bi-monthly crops of Silk which alone grow in Mysore, the cause of failure will be at once evident. The leaves of a plant are organs of respiration, digestion, and nutrition, a tree cannot be made to yield 5 or 6 crops annually without seriously impairing its vitality. If the leaves are stripped off a plant before the fruit has commenced ripening, the fruit will fall off and not ripen. If a branch is deprived of leaves for a whole summer, it will die, and not increase in size perceptibly, and this is exactly what has taken place with the standard trees at the Silk garden, they have aged, become woody, and throw out nothing but fruit unless pruned back to the stems, when an entire new set of branches is thrown out with an abundant crop of fine leaves; these branches by the loss of their leaves age and die within the year, and the same process has to be renewed; latterly the only mode of obtaining good leaves from the standards has been by cutting them down to the ground, the roots then throw up abundant fine shoots, a proceeding which in effect is returning to the bush system. On this subject I quote the following passage from a valuable little work by Count Dandalo on the "art of rearing Silk worms." He says "It has been said, that in Asia they obtain as many as "twelve crops of cocoons in a year. "And some person made ex- "periments, and published some views on the subject; stating, that "with us (that is in Italy) there might, at least, be gathered two "crops; my experiments on the contrary tend to prove, that it "would be a sure method of destroying the Mulberry trees, and "consequently the entire breed of Silk worms. I cannot indeed "bring myself strictly to believe, that in Southern Asia it should "be possible to have such numerous crops of cocoons. The "Southern part of China corresponds very nearly, as to climate, "with the Southern parts of Persia, and yet there, according to

" the illustrious Pallas, the boughs of the Mulberry trees are cut " only twice in the year, so as to have in the same year two " crops of cocoons. In those climates they prune the small branches " twice a year, because the summer being longer, the Mulberry " tree is more vigorous there than it is with us. Here, on the " contrary, the Mulberry tree cannot even bear the stripping of " its foliage once a year without being injured, and certainly " would die if stripped twice."

4. The Count is misinformed in regard to the number of crops annually. In this country 6½ crops are the utmost ever obtained, each crop occupies 56 days, 33 in the worm, 12 in the cocoon, 11 in the egg, the insect requires food for 198 days in each year, where the succession is regularly kept up. The cultivation by standard trees is obviously not adapted to meet such an incessant demand. Of this, the Natives are perfectly well aware, for Doctor Royle in speaking of the cultivation of the standard Mulberry, says, " This " practice is not entirely foreign to the Natives, as the Resident at " Baulleah states that the annual worm prefers the leaf of the shrub " which is well matured, to that which is young and tender, and " therefore he infers that it would thrive better with the tree " leaf than the shrub leaf. He also says, that the tree is culti- " vated in parts of the Rungpore and Radnagore districts for the " production of cocoons. The Resident at Hurripal states, that " there, the method of cultivation differs from that in use about " Baulleah and Malda, the leaves being gathered only from standard " trees, which are preferred on account of the dryness of the soil " in that district."

5. The following are two Extracts from a paper taken out of an old Chinese work on the cultivation of Silk of sufficient interest for insertion in this place. After describing at length the management of the worms for an annual crop, or a spring and autumn one at most. He says " for if they (the Mulberry " trees) are quite stript one year, they die and fail entirely the " spring following." After speaking of the necessity for feeding the young worms every half hour during the first 24 hours of their life, he says, " The reason why they take so much pains

"to make these little insects eat so often, is to forward their "growth and make them spin the sooner, the great profit which "they expect from these creatures depends upon this care, if they "come to their full growth in twenty-three or twenty-five days "a hurdle covered with worms, whose weight at first was a mass, "that is a little more than a drachm, will produce twenty-five "ounces of Silk, whereas, if for want of proper care and nourish- "ment, they do not come to their perfection in less "days, they will produce but twenty ounces, and if they a "month or 40 days in growing, they will have but about 10 "ounces." This is a most interesting fact, and applied to breeding in general, shows the vital importance of supplying young stock with abundant nourishment while growing, there is perhaps no other instance in nature, in which such an experiment could have been so accurately tried and its results ascertained with almost mathematical precision.

6. On the subject of the comparative merits of the standard and bush modes of cultivating the Mulberry, I wrote to the Secretaries of the Horticultural Societies of Bengal and Bombay, fro the latter I received no reply, which I regret, for I was anxious to know how far Signior Muttis' plan had answered under his own superintendence. The Secretary to the Calcutta Agri-Horticultural Society writes as follows: "The system of growing the Mulberry "as a standard tree, has been tried in Bengal, and, so far as the "result of my enquiries enables me to say, with as little success "as has attended the experiment of the St. Helena variety on your "side of India. The common bush Mulberry is very much pre- "ferred by the people at Surdah, Commercally, Radangore, and I "believe, all other parts of Bengal, where Silk cultivation prevails."

7. More than one private speculation with standard trees failed at Chittoor, and Conoor, under energetic and intelligent European superintendence. I have no reason to think that the experiment has failed from any want of care or attention on the part of the attendants, they have done their best, and if the Commissioner will refer to the report of the Bengal Horticultural Society on the specimens of Silk sent to Bengal in 1846, he will there see that the qualifications of the reeler at the garden are

first-rate. I have lately found when obliged to hire reelers to wind off a large crop that it is not difficult to get very good reelers among the Natives, and the reason why the Natives do not practice reeling their own Silk cleanly and fit for the European market, is that it is not saleable in this country and there is a demand for all that can be produceed reeled in the country fashion, independently of which the increased value of the Silk cleanly reeled will not compensate for the loss of weight and increased time and expenses of reeling.

8. The standard trees are all worn out and useless, they require to be replanted, and if replaced by young trees not a leaf should be taken from them for the next five years, a large portion of the garden is laid down with the common country bush Mulberry cuttings, of the St. Helena for standards are planted at distances of 20 or 30 yards from each other among the bushes, and this I think is the proper way of growing standard trees, which thus planted, in no way interferes with the bush system, and at the same time afford food in seasons when from want of water or other causes the bushes fail. The Philippine planted as bushes have not answered, though the leaf is large and nutritious, it is said by the Natives not to yield an equal weight of food on the same space of ground.

9. I beg respectfully to suggest to the Commissioner either that the entire garden be laid down in the country fashion with standard trees at intervals as above described, or else that it be let out to Natives to be cultivated in their own way, keeping up the present breed of worms which are very superior to their own in the bright colour of the Silk.

BANGALORE,
11th August 1849. } (Signed) C. J. SMITH.

At present the cultivation of Silk is carried on by the Natives in their own way, and by the bush system which they have found practically the best.

(True Copy.)
(Signed) J. CUNNINGHAM,
Secretary.

Resolved that the foregoing letter and the report which accompanied it be communicated to the General Committee of the Madras Exhibition in reference to Extract Minutes Consultation, 10th Ultimo, No. 757, para. 5.

(True Extract and Copies.)

E. MALTBY,

Acting Chief Secretary.

To the General Committee of the Madras Exhibition.

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